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Letter from the Editor

I want to welcome our readers to the latest volume and edition of *The Oak Leaf*. We are excited about the quality of the research presented by students and thank their mentors for their invaluable support. In this letter, I will introduce the students and their research, introduce new members of the publishing team, discuss changes to *The Oak Leaf*, highlight opportunities to present research coming up in the 2024/2025 season at LSUA and outline the responsibilities of mentors in the publishing process.

In our latest volume, Chapel Cook (mentor: Krista Redmond, LSUA) discusses “Word-Specific Explicit Vocabulary Instruction in the Secondary Content Area Classroom”; Ann Crabtree (mentor: Meredith Veldman, LSU A&M) explores the theme of “Under the Knife: Victorian Medicine and Public Perception”; Keely L. McLeod (mentor: Julie Gill, LSUA) focuses on factors responsible for “Cardiac Abnormalities in Young Athletes”; Kimberly Mojica (mentor: Krista Redmond, LSUA) highlights “Creating an Inclusive Learning Environment in the Elementary Classroom”; Peyton Ryder (mentor: Krista Redmond, LSUA) introduces the reader to “Best Practices of Creating Feedback Loops Through Strategic Questioning During Classroom”; and Courtney Zeissler and Maeve Ladd (mentor: Christof Stumpf, LSUA) present their study on “Abundance and Diversity of Bees Collected in Central Louisiana in Summer 2023.” The publishing team would like to congratulate all undergraduate students for their outstanding work and would also like to thank all mentors, especially Krista Redmond (who worked with three students separately), for their efforts in helping students get published. The editor-in-chief would like to emphasize that he gave up all editing responsibilities for the publication of his mentees. We also extend our gratitude to all managing editors and reviewers for their indispensable work.

Several new people have joined our team: Christopher Stacey is the new managing editor for the social sciences. After publishing a book on professional wrestling, he transitioned into editing. It should be noted that Stacey has previously served as a student mentor and reviewer for papers previously published in *The Oak Leaf*. The entire team would like to thank our past editor, Zebulon Bell, for his editing skills and for sharing the insights that propelled *The Oak Leaf* forward. We wish Zeb well in his exciting new responsibilities. We are delighted to welcome James Miksanek, who joined the Department of Biological Sciences at LSUA as a new faculty member and is the new permanent managing editor for the natural sciences. Additionally, Taylor Greenhouse and Carli Smith have joined us as style editors. They will work with students to ensure that grammar, vocabulary, and style meet the standards of scholarly publication.

This year, we will publish only one edition for volume four, which will likely continue for the foreseeable future. The burden on the publication team housed in CORE has been particularly heavy, and the current volume of submissions does not justify publishing two issues. This may change when we receive more submissions from LSUA and other universities around the state. Submission deadlines for the 2024-2025 volume will center around mid-February, but submissions will be accepted year-round. Submissions must be submitted through a newly created Moodle course site, which will avoid confusion in email communications and allow the editing team to access the latest version of a paper throughout the various stages of reviewing and editing. For submissions from institutions outside LSUA, no Moodle account will be available. Therefore, they should be directed toward the Editor-in-Chief. We request that the publication team handle paper formatting rather than the authors. Figures and tables must be submitted as separate files with the highest available file sizes and resolutions for clarity and readability.

Additional opportunities to highlight student research on the LSUA campus occur on March 15, 2025, when the Louisiana Academy of Sciences holds its annual meeting, and April 30, 2025, for LSUA’s Scholar Day. It is acceptable for a student to present their findings at either of these conferences and in *The Oak Leaf*, provided their work has not been submitted to any other scholarly publication.

I want to finish my letter with a special thanks to the faculty mentors. Mentors shepherd our students through transforming a good course paper into a publishable work. They identify promising papers and encourage their students to submit them. They help students apply the suggestions of the style editors before the submission is sent to the reviewers. When the reviewers return the submission, faculty mentors provide an invaluable role in helping students understand and implement reviewer feedback. Mentors assist their mentees when managing editors require final edits. All of this takes quite a lot of time and attention to detail. For these reasons, the mentors are essential for this publication.

We eagerly await your submissions to *The Oak Leaf* and hope your instructors and mentors can convince you that a publication is always worth the effort.

A handwritten signature in black ink, appearing to read 'Christof Stumpf', with a large, sweeping flourish extending from the end of the name.

Christof Stumpf

Editor-in-Chief, *The Oak Leaf*

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Abundance and Diversity of Bees Collected in Central Louisiana in Summer 2023

Courtney Zeissler, Maeve Ladd
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Louisiana State University at Alexandria

Abstract

The intent of this research was to compile a list of different bee species in central Louisiana. We collected and identified bees (Hymenoptera: Apoidea) from several sites in Central Louisiana and adjacent parishes (Avoyelles, Rapides, Vernon, and Winn parishes). We collected and identified voucher specimens utilizing morphology or DNA barcoding of the CO1 and 28S genes. When possible, visual identifications were recorded for subsequent observations to avoid over-collecting. We recorded a total of 89 individuals from 18 species in five different families. We identified four individual bees through DNA barcoding. Our list of bee species will be beneficial to future research endeavors in central Louisiana.

Introduction

As of 2022, there are a total of 214 species of bees in 36 genera and six families documented in Louisiana (Hall and Tyler 2022; Owens et al. 2018). These include the families: Andrenidae, Apidae, Colletidae, Halictidae, Megachilidae, and Melittidae (Owens et al. 2018). Apidae is the most speciose family in Louisiana (54 species), followed by Halictidae (42 species). However, there are no bee species known to be endemic to Louisiana (Bartholomew et al. 2006). An endemic species refers to a native species only found within a specific area, whereas native can refer to an entire continent. All species found during this research are native to the US with the exception of *Apis mellifera*, the honeybee (Table 1). The purpose of our research was to collect a sample of the biodiversity and abundance of native bees in Central Louisiana, focusing on longleaf pine, prairie, and areas with native flower growth, either wild or cultivated.

The study areas were located in Central Louisiana including Rapides, Avoyelles, Vernon, and Winn parishes. Focal points of the study included the Winn

ranger district of the Kisatchie National Forest as well as Allen Acres bed and breakfast located in Pitkin, Louisiana. Within the Kisatchie National Forest, we focused on prairies located within the forests due to lack of research in these specific areas. Bartholomew and Prowell (2006) demonstrated that within the two types of longleaf pine savanna communities in southern Louisiana, bee abundance and species richness is greater within the upland woodlands than the wet pine flatwoods and is affected by the age and size of preserves, as well as fire management.

Materials and methods

We collected and documented multiple voucher specimens per site. We identified individual specimens morphologically. The principle method of collection was hand-netting. Upon capture in the net, we used 75% ethanol to stun the specimen preventing movement, with eventual transfer into a kill jar. For a kill jar, a glass jar is filled 2–3 cm with plaster of Paris at the bottom. This porous material is saturated with ethyl acetate ($\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$). The fumes then kill the

specimen which is carried into the lab for pinning and identification. When unsure based on morphology alone, a subset of specimens was sequenced for the COI mitochondrial and 28S ribosomal DNA genes. We collected and pinned any additional specimens of the same species for reference. When possible, we identified additional specimens of pinned species visually or by collection in the field, and then released. In the event that identification was uncertain in the field, we collected specimens and identified and documented them in the laboratory. Using a variety of keys, identifications were performed by the authors with assistance from Dr. Christof Stumpf (Carril and Wilson 2021; Holm 2017; Wilson and Carril 2016).

To obtain a greater collection of specimens, Kisatchie National Forest (31.93386, -92.82408, and 31.93337, -92.82764) and Allen Acres (30.94308, -93.04882) were cycled through weekly. We planned to include more than one type of savanna in our research and had to ensure that no fire management would occur during the length of the study. The total time spent collecting was estimated to be about 70 hours (~40 hours at Allen Acres, ~27 at Kisatchie National Forest, and ~3 hours at varying locations). The span of collecting was from May 31, 2023 to July 14, 2023 with nine collection days at Allen Acres and four collection days at Kisatchie National Forest. The specimens that were collected are housed in Louisiana State University at Alexandria's insect museum.

DNA extraction was performed using E.Z.N.A. Insect DNA Kit (Omega Bio-tek, Norcross, GA). The specimen (or portion of a specimen depending on size) was placed into a microcentrifuge tube with a buffer solution and proteinase K for maceration. The mixture was heated to 60°C and centrifuged. The aqueous solution was then removed and prepared for PCR via application of a 24:1 mixture of chloroform:isoamyl alcohol followed by the use of RNase A to degrade the RNA strands. The resulting DNA solution was bound to a Hibind DNA mini column by centrifugation and washed out into elution buffer.

PCR protocol was as follows: Initial denaturation at 94 °C for 2 minutes; 40 cycles of 30 seconds at 94 °C, 45 seconds at 50 °C, and 1 minute at 72 °C; and final extension for 10 minutes at 72 °C. The resulting DNA was sent to a commercial lab (Eurofins Genomics LLC, Louisville, KY) for Sanger sequencing. After visual inspection of the chromatogram in 4Peaks (<https://nucleobytes.com/4peaks/index.html>) on the Macintosh, sequences

with the most uniform peak distributions were chosen for submission to NCBI blastn suite (https://blast.ncbi.nlm.nih.gov/Blast.cgi?PROGRAM=blastn&PAGE_TYPE=BlastSearch&LINK_LOC=blasthome) and BOLD SYSTEMS species level barcode records (https://www.boldsystems.org/index.php/IDS_OpenIdEngine). Matches to resulting sequences were obtained by comparisons to sequences stored at the NCBI (National Center for Biotechnology Information) and BOLD (Barcode of Life Data System) databanks. Criteria were at least 99.8% identity on NCBI and species level match on BOLD.

Results

We collected a total of 89 bees that were either captured (50) or observed (39) (Table 1). The majority of specimens collected and/or observed (65) were from Allen Acres. We were able to obtain nine specimens, both collected and observed, from the Winn Ranger district of Kisatchie National Forest. In addition, six specimens were captured on the Louisiana State University at Alexandria campus, three in Deville, LA, two in Alexandria, LA, two in Bunkie, LA, one in Cheneyville, LA, and one at Lake Buhlow.

We collected specimens in five different bee families. The most prominent family collected or observed was Apidae (70 of the total 89 individuals), followed by the family Halictidae with a total of 11 specimens. Additionally, three specimens were identified as Megachilidae, two as Melittidae, and two as Colletidae (Table 1).

There were four positive identifications made via DNA barcoding after completing PCR on a total of 6 specimens. These positive identifications were of *Agapostemon* sp., *Svastra obliqua*, *Halictus poeyi*, and *Melissodes bimaculatus*.

Discussion

Of the total of 214 species in six different families found in Louisiana (Hall and Tyler 2022; Owens et al. 2018), we were able to collect and identify 18 species in five different families. We were unable to obtain any specimens in the family Andrenidae (Table 1). We are not certain why this was the case. We believe that increased sampling efforts will allow us to collect Andrenidae in the future.

The most common species found was the Virginia carpenter bee, *X. virginica* (Table 1). Carpenter bees have evolved structured societies with cooperative nestmates to prevent inbreeding and to increase the survival rates of offspring (Vickruck and Richards 2021). The large size (19–25 mm long) of the carpenter bees enables them to be easily spotted for recording observations in the field (Wilson and Carril 2016). We suspect the larger number of carpenter bees collected and/or observed likely stems from them being easily spotted due to their size.

In addition, honey bees, *Apis mellifera* (Table 1) were also very common. Honey bees, while not native to the US, are bred throughout and are nearly ubiquitous, occurring in large numbers per hive (The Honeybee Genome Sequencing Consortium 2006).

Aside from the most prominent species collected, there were specimens that had not been identified in the area before, specifically at the Allen Acres location. These included *Agapostemon* sp., *A. splendens*, *Ashmeadiella buconis*, *Augochlora pura*, *Colletes* sp., *Florilegus condignus*, *Halictus* spp., *Megachile rotundata*, *M. xylocopoides*, and *Svastra obliqua* (C. Allen, personal communication with authors, June 1, 2023). We could only differentiate between *H. ligatus* and *H. poeyi* with the help of DNA barcoding, as was done with the specimens from Rapides parish (Table 1). A single *Halictus* specimen from Allen Acres was not barcoded and could have been either *H. ligatus* or *H. poeyi*. All of these species were added to the cumulative species list provided by the past researchers at Allen Acres for other researchers to use in the future.

We found far greater bee abundance at Allen Acres than at Kisatchie National Forest. Although sampling effort were different, it was clear there were fewer bees at Kisatchie National Forest than at Allen Acres. It is likely that Allen Acres has greater abundance due to the number of pollinator plants present. The property is managed to support pollinators through diverse plantings including native plant species, whereas Kisatchie consisted of mostly tall grasses with very few non-wind pollinated flowering plants spread widely. However, due to a short time period and limited collection events, we were not able to obtain truly conclusive results to compare the two sites. A similar study collected a total of 1053 specimens (Hall and Tyler 2022), whereas we were only able to capture 89 specimens. Additionally, this study included seven different parishes (Bossier, Caddo, Claiborne, Natchitoches, Red River, Webster,

and Winn parishes), while our study included only four (Avoyelles, Rapides, Vernon, and Winn parishes).

The lower bee abundance at Kisatchie compared to Allen Acres could be due to many different factors. Svensson et al. (2000) discovered that bees are often found in greater numbers in relatively open areas especially along field, road, and forest boundaries. Our data supports this finding as the prairies were open spaces in which we only found bees along the edges of the roads and forests. The Allen Acres site was less open with greater floral diversity allowing for larger numbers of bees. The fact that specific plants such as mountain mint (*Pycnanthemum* sp.) and beebalm (*Monarda* sp.) had been planted to attract pollinators could also explain the difference in bee abundance and diversity in both sites.

Only four of our total 6 PCR runs lead to species identifications. However, of the specimens we were able to perform PCR on we obtained results of 99.8% matches for *Agapostemon* sp., *S. obliqua*, *H. poeyi*, and *M. bimaculatus*. DNA barcoding of insects has become an additional tool in the arsenal of the insect taxonomist (Shashank et al. 2022). However, it is prone to Type II errors due to missing species in the database that lead to incorrect identifications (Virgilio et al. 2010). We tried to overcome this problem with only accepting very high percentage matches that only lead to single species identifications.

In future studies, more collection days will be beneficial if suitable transportation is available. For our sequencing attempts, we did not have access to liquid nitrogen for complete breakdown of all tissues which resulted in pieces of exoskeleton interfering with further steps in DNA extraction and therefore with PCR. A new thermoshaker with shaking capability of several thousand rpm should help with better solubilization of ground-up tissues and should result in successful DNA extraction in bee specimens with thick exoskeletons and large surface:volume ratios. This collection of bee species provided a list of 17 species found at Allen Acres that had not been reported on the property before. This study is worth repeating, as our knowledge of bees in Central Louisiana is still sparse.

Acknowledgements

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Maddison Johnson, Kim Mchale, Grayson Headrick, Alleigh Perles, and Aliyah Johnson for their help with collecting specimens. We appreciate assistance and guidance given to us by Cheryl Bardales and the additional assistance of David Moore, Stacey Bloomquist, and Carol Corbat in their help with finding suitable collection sites. We would like to thank the staff at the Kisatchie National Forest office in aiding us with obtaining the proper permits necessary to collect within the site. We would like to thank Charles Allen, the staff of Kisatchie National Forests Winn Ranger district, the United States Department of Agriculture, and Mr. and Mrs. Deville for assisting and allowing us to collect on their site. This research was funded by the Louisiana State University of Alexandria's S.U.R.E. research internship program.

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Table 1. Families, genera, species, locations, and number of bee specimens collected and observed in Central Louisiana in summer 2023.

Family	Species	Location	Collected – observed
Apidae	<i>Apis mellifera</i>	Allen Acres	6 – 12
Apidae	<i>Bombus pensylvanicus</i>	Allen Acres	2 – 0
Apidae	<i>Florilegus condignus</i>	Allen Acres	2 – 0
Apidae	<i>Svastra obliqua</i>	Allen Acres	2 – 1
Apidae	<i>Xylocopa virginica</i>	Allen Acres	2 – 21
Colletidae	<i>Colletes</i> sp.	Allen Acres	2 – 0
Halictidae	<i>Agapostemon</i> sp.	Allen Acres	1 – 0
Halictidae	<i>Agapostemon splendens</i>	Allen Acres	1 – 0
Halictidae	<i>Augochlora pura</i>	Allen Acres	5 – 0
Halictidae	<i>Halictus</i> spp.	Allen Acres	2 – 0
Megachilidae	<i>Ashmeadiella buconis</i>	Allen Acres	1 – 0
Megachilidae	<i>Megachile rotundata</i>	Allen Acres	1 – 0
Megachilidae	<i>Megachile xylocopoides</i>	Allen Acres	1 – 0
Melittidae	<i>Melitta americana</i>	Allen Acres	1 – 0
Melittidae	<i>Melitta melittoides</i>	Allen Acres	1 – 0
Unknown	unknown	Allen Acres	1 – 0
Apidae	<i>Apis mellifera</i>	Kisatchie National Forest	2 – 0
Apidae	<i>Bombus pensylvanicus</i>	Kisatchie National Forest	1 – 2
Apidae	<i>Melissodes bimaculatus</i>	Kisatchie National Forest	1 – 0
Apidae	<i>Xylocopa virginica</i>	Kisatchie National Forest	0 – 3
Apidae	<i>Melissodes bimaculatus</i>	Deville	2 – 0
Apidae	<i>Xylocopa virginica</i>	Deville	1 – 0
Apidae	<i>Apis mellifera</i>	LSUA	5 – 0
Apidae	<i>Xylocopa virginica</i>	LSUA	1 – 0
Apidae	<i>Apis mellifera</i>	Bunkie	1 – 0
Apidae	<i>Xylocopa virginica</i>	Bunkie	1 – 0
Halictidae	<i>Halictus poeyi</i>	Alexandria	2 – 0
Apidae	<i>Apis mellifera</i>	Cheneyville	1 – 0
Apidae	<i>Xylocopa virginica</i>	Lake Buhlow	1 – 0



Word-Specific Explicit Vocabulary Instruction in the Secondary Content Area Classroom

Chapel Cook

Mentor: Dr. Krista Redmond

Louisiana State University at Alexandria

Abstract

Word-specific explicit vocabulary instruction promotes reading comprehension and writing skills through the explicit teaching of target vocabulary words with an interactive strategy. In addition to those skills, explicit vocabulary instruction aids English as a second language (ESL) learners in fluency. This type of instruction supports student success in retaining and producing the target vocabulary words in the future. Word-specific explicit vocabulary instruction strategies include, but are not limited to games, worksheets, teacher-led discussion on target words, and interactive definition activities. Such explicit vocabulary strategies were implemented in a week-long content area-focused unit of study in a sixth-grade middle school classroom. As a result, student success was substantial throughout a week-long instruction period as evidenced by an increase in post-assessment scores.

Introduction

Word-specific explicit vocabulary instruction, an educational strategy where target words for student success are explicitly taught to students while they interact with them during the learning process, is a strategy that improves student reception and production of vocabulary words (Vincy, 2020). This form of vocabulary instruction requires teachers to plan specific time to directly teach the target words, and the teachers facilitate interaction with the target words through a writing prompt, a game, or an interactive reading activity. Word-specific explicit vocabulary instruction is useful for all students, but it is particularly helpful for ESL (English as a second language) and SLD (spoken language disorder) students. The studies reviewed explored the efficacy of word-specific explicit vocabulary instruction and then were referenced according to ESL students and SLD students.

Literature Review

Word-Specific Explicit Vocabulary and ESL Learners

Dixon et al. (2020) explored how word-specific vocabulary instruction improved reading comprehension for students who have learned English as a second language (ESL). For ESL learners, there is an expectation that exposure to the language will allow them to integrate successfully into studies in the English language. However, ESL students underperform compared to native English speakers (Strand et al., 2015, as cited in Dixon et al., 2020). This statistic suggests ESL students require more support for success (Dixon et al., 2020). First, the students were selected from a pool of ESL students. The method taken by the researchers was a timeline of 18 months where participants took a baseline test and a pretest. Next, the 10-week vocabulary intervention took place. The words taught in the intervention were Tier 2 target words. The participants took a post-test after the interventions, and six months later they took a maintenance test to measure the amount of information that was learned (Dixon et al., 2020). The results were positive for student progress in the 10-week vocabulary intervention. The students showed progress on the post-test after the precise focus vocabulary. The students also retained the vocabulary

knowledge on the six-month maintenance test (Dixon et al., 2020).

A similar study performed by Vincy (2020) also investigated the efficacy of explicit vocabulary on the reception and production of vocabulary knowledge development. Vincy gathered data from an experiment that took place over eleven weeks with an average of four hours per week of explicit vocabulary instruction. The participants were sixty-two sixth-grade students from a government school in Tamil Nadu, a large state in India, separated into a controlled and experimental group. The control group was taught the traditional route with the vocabulary words, however; the experimental group was taught the vocabulary words with supplemental instruction (Vincy, 2020). The experimental group experienced significant increases in scores compared to the control group. In comparison, the control group had no significant change from the conventional way of vocabulary instruction. The results showed that explicit instruction and exposure to vocabulary words had a notable influence on the reception and production of target words (Vincy, 2020).

Further supporting the efficacy of explicit vocabulary instruction with ESL learners, a study completed by Solati-Dehkordi and Salehi (2015) studied the importance of explicit vocabulary instruction on writing ability for English for second language learners. The researchers gathered data from a researcher-modified passage that the participants read, post-reading pre-instruction writing on that passage, post-instruction writing to test their knowledge, and delayed writing twenty-one days later to re-test their knowledge of the vocabulary. The participants were thirty upper-intermediate English-speaking females from a school in Iran (Solati-Dehkordi & Salehi, 2015). The results for student retention of the vocabulary words in their writing skills were successful. The participants' reception and production of vocabulary increased after explicit vocabulary instruction was taught (Solati-Dehkordi & Salehi, 2015).

The study by Vincy and the study by Solati-Dehkordi and Salehi have a common component in that both experiments were centered on the reception and then production of ESL learners. Researchers in both studies wanted to explore if supplemental vocabulary instruction would improve the vocabulary of ESL students for their benefit in becoming proficient enough in the English language to successfully use it. The

results of both studies were similar in that they showed student success in vocabulary after supplemental instruction was taught.

Word-Specific Explicit Vocabulary Instruction and Language Disorders

The purpose of the study was based on the premise that explicit vocabulary instruction embedded in an Interactive read-aloud (IRA) can help students with and without Spoken Language Disorders (SLD). Myers and Ankrum (2018) aimed to explore if children with an SLD can use explicitly taught vocabulary words and if they acquire vocabulary in the same manner as children with an SLD. These two questions guided their research as they investigated the effectiveness of explicit vocabulary instruction. Data was gathered from a sample of three kindergarten students from a rural school in Pennsylvania. Two of the three students had a Spoken Language Disorder, and the third student did not. The students participated in an interactive read-aloud for 12 sessions with three different observers. The teacher would teach a word, give the definition, use an example from the text at hand, and lastly provide a real-life example with the word. Next, the students would turn and talk about the word that was just taught (Myers & Ankrum, 2018). The dialogue between the students was examined for the study to see if the students could grasp the concept of the words with explicit vocabulary instruction. Myers and Ankrum found the results of their study to be students with and without an SLD benefit from explicit vocabulary instruction intertwined within an Interactive Read Aloud. The students grasped the concept of the word from the instructor, and they used the words correctly in their peer discussions (Myers & Ankrum, 2018).

Another study related to the subsequent one by Myers and Ankrum discussed the importance of teaching word-specific explicit vocabulary instruction to students with a learning disability (LD). Beach et al. (2015) explored vocabulary methods word selection and the effects of student achievement across content areas. In particular, the study was focused on one teacher's style of teaching explicit vocabulary instruction (Beach et al., 2015). The teacher chose Tier 2 words when choosing his words to teach explicitly. Tier 2 words are important to understand for a range of academic disciplines (Beck et al., 2008, 2013; as cited in Beach et al., 2015). The researcher's method was to "1. Select four Tier 2 words to teach each week. 2. Introduce words. Provide student-

friendly explanations, definitions, and synonyms for each word 3. Facilitate discussion of the meaning of each word in illustrative instructional and authentic contexts. 4. Engage students in wordplay. 5. Provide scaffolded writing opportunities” (Beach et al., 2015, p. 3). The results for overall reading comprehension were positive for furthering the success of reading comprehension for students with an LD.

Both sets of researchers in this category explored how interactive definitions and creative strategies for students with learning disorders can greatly improve their performance in reading comprehension. The results of the studies proved to be like the students with language disorders who benefited from the word-specific explicit vocabulary instruction.

Summary and Conclusion

Word-specific explicit vocabulary instruction improves student reading comprehension (O’Connor, 2015), literacy development (Kindle, 2009, as cited in Myers & Ankrum, 2018), reception and production of vocabulary (Vincy, 2020), and writing skills (Solati-Dehkordi & Salehi, 2015). In particular, ESL and SLD student vocabulary is improved when explicit vocabulary instruction and interaction with the words are taught to them. Student growth in vocabulary is shown to be possible through teachers carving out time for supplemental instruction. The supporting literature provides backing for action research by demonstrating that students can improve their academic performance across various content areas through explicit instruction focused on specific vocabulary words.

Methods

Twenty-five students in a 6th-grade middle school classroom between the ages of 11-12 participated in the research. The class consisted of 14 males and 11 females. 2 students received English as a Second Language (ESL) accommodations. The two students who received ESL services did not take part in the pre or post-test due to their accommodation requirements. 56 percent of the students were Hispanic, and 44 percent were white. According to state records, the school’s overall student assessment report card score is a B. The educator who created and implemented a week-long content area unit of study was a pre-service teacher in the final year of residency. The unit of study aligned

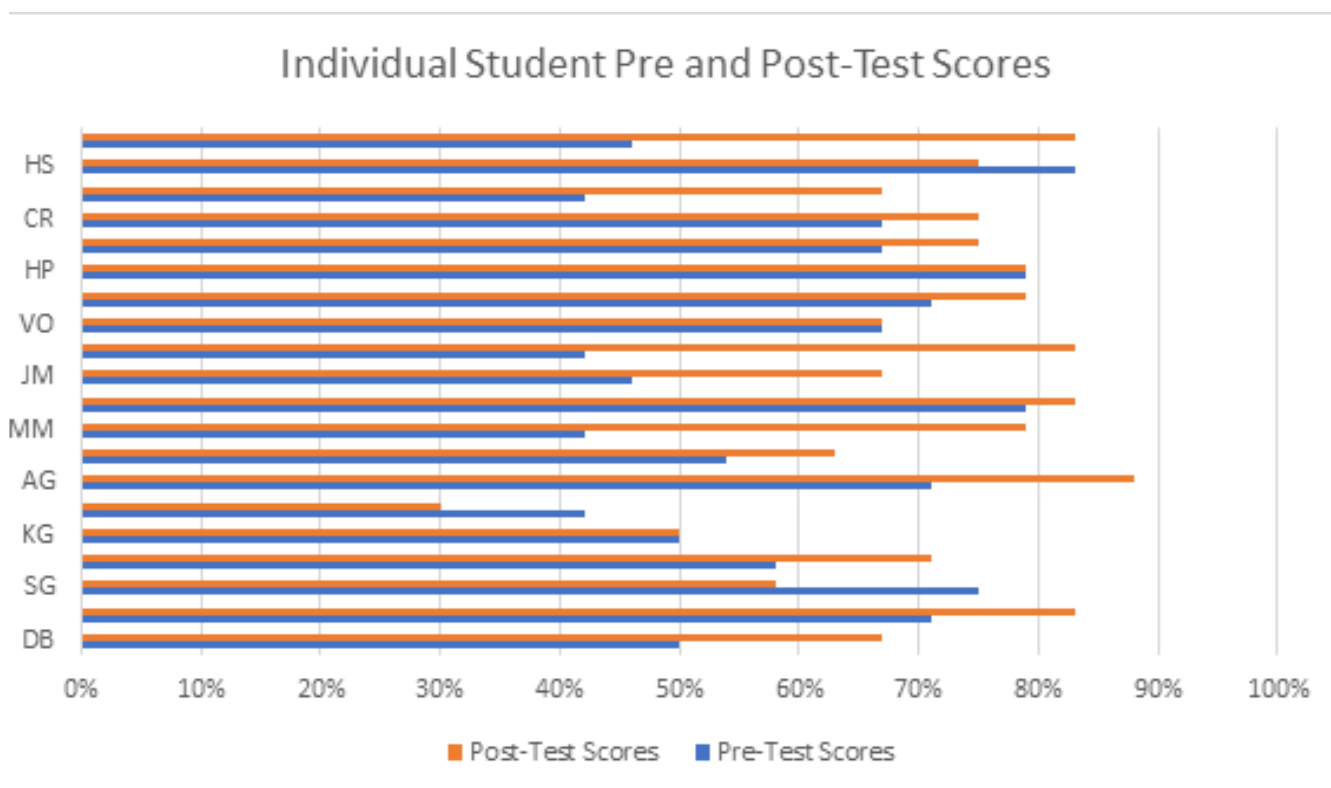
with English standards related to summarization, word meanings, and context clues.

Before implementing the content area unit plan, three sets of assessment data were reviewed for each student within the class: STAR Reading, iReady Reading, NoRedInk Louisiana Grade 6 Benchmark. In addition, both a cultural and learning styles inventory were administered to each student in the class. State records were reviewed to obtain an understanding of school-wide performance assessment scores. The data gathered before the planning and implementation of the content area unit plan guided the instructional design of the unit. An emphasis was placed on the effective instruction of explicit vocabulary strategies. These strategies included vocabulary games, a vocabulary log, and interaction with target vocabulary words through context clues strategies. The same pre and post-tests were administered before and after the implementation of the week-long content area unit plan. In addition, student progress was tracked related to mastery of the unit standards throughout the week.

Results

The class average of the unit formal assessment was 62 percent on the pre-test. After the implemented week-long instruction, the class average was 72 percent. All but 6 out of the 25 students’ scores increased. Out of those 6 students who did not increase, 3 of the students did not decrease in their scores but rather stayed at the same score. After the detailed analysis of student performance of the unit’s vocabulary questions on the formal assessment, it was determined that 86 percent of the class missed less vocabulary on the post-test than on the pre-test. Let it be noted that on post-testing day, 5 out of 25 students do not have complete data sets due to unforeseen circumstances and ESL accommodations. The conclusion can be drawn that the effective implementation of explicit vocabulary instruction throughout the week-long content area unit plan increased most of the students’ achievement related to vocabulary.

Figure 1.1



Conclusions and implications for futher research

In conclusion, the gaps in research on word-specific explicit vocabulary instruction are lacking for adolescents. Although the study by researchers Solati-Dehkordi and Salehi (2015) on the efficacy of explicit vocabulary instruction for writing purposes has been explored, there are opportunities for the expansion of knowledge on the impact of explicit vocabulary on the reception and production of language. Many studies for explicit vocabulary instruction are for ESL students, therefore more research should be conducted to test the effectiveness of explicit vocabulary instruction on students with no accommodations. Similarly in this action research study by Vincy (2020), the researcher studied the efficacy of explicit vocabulary knowledge on the reception and production value for adolescents, and the conclusion proved to be positive results for student success. However, the participants were ESL students. The researcher of this action research study found that explicit vocabulary instruction is a strategy to improve adolescent students' reception of target words for success in multiple academic fields. This study is a minority in this field of research on the impact of explicit vo-

cabulary instruction on adolescents. Based upon both the literature reviewed and the results of this action research study, the conclusion can be drawn that research is lacking for the efficacy of explicit vocabulary instruction on adolescent students without accommodations for success in reading comprehension.

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Cardiac Abnormalities in Young Athletes

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Abstract

Cardiac abnormalities are one of the leading causes of sudden deaths among young athletes. The recent emergence of such abnormalities has drawn significant public attention, prompting continuous examination and analysis of any underlying causes. This paper proposes to discuss and highlight the triggers of these counterintuitive tragedies and delve into various factors that may influence the prevalence of abnormalities and mortality rates within this population. The intricate and complex nature of these events presents challenges for medical experts in determining their exact etiology. Nonetheless, the significance of predispositions and genetic background is heavily considered when assessing these events. Other potential contributors to cardiac abnormalities include the consumption of energy drinks, the use of vaping devices, the misuse of performance-enhancing substances, the impact of COVID-19 and its medical interventions, chronic stress, and mental illnesses. By comprehensively exploring these factors, the research aims to provide a thorough understanding of how they may contribute to cardiac inhibitors. Additionally discussed, are the current screening and diagnostic methods used to detect and prevent undiagnosed cardiac conditions, with the goal of reducing the incidence of sudden cardiac death among young athletes. These methods are supported by the rigorous research published in professional journals, which provides valuable insights into the prevention and management of cardiac abnormalities in young athletes.

Cardiac abnormalities are one of the leading causes of sudden cardiac death (SCD) among young competitive athletes, accounting for 75% of all fatalities during sports and exercise. A variety of structural, electrical, and acquired cardiac disorders may predispose a young athlete to sudden cardiac arrest (Drezner et al., 2019). The sudden death of young athletes during exercise is a tragic incident and an unexpected substantive medical issue. The demographic victims are those who represent the healthiest and most dynamic members of society: high school and collegiate athletes. In recent years, these catastrophic events have received widespread media attention and have had a profound effect on public consciousness.

Cardiac irregularities have been identified to have increased in youth and young athletes. While it is

difficult to determine the exact mortality of athletes due to no updated comprehensive registry of such cases, a study in 2012 states, “there are approximately 100 to 150 sudden cardiac deaths (SCD) during competitive sports each year with young athletes experiencing an SCD every 3 days on average” (Link & Estes, 2012, p. 2511). Additionally, the American Academy of Pediatrics estimates that “approximately 2,000 people under the age of 25 die from sudden cardiac arrest in the U.S. each year” (Campbell et al., 2012, p. 1094). This paper proposes to break down the triggers of these counterintuitive tragedies and discuss the various factors that may influence the rise in cardiac abnormalities and mortality among young athletes. Additionally, the current screening and diagnostic methods used to detect and prevent undiagnosed cardiac conditions, lower the

incidence of SCD, and draw on the rigorous research of professional journals will be discussed.

There are several types of cardiac abnormalities that can cause sudden cardiac death in young athletes. The most prevalent inherited malformations are hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy, anomalous coronary arteries, and ion channelopathies (Rowlett et al., 2021). These conditions can cause major structural or electrical abnormalities in the heart, which can result in arrhythmias and sudden cardiac arrest. Hypertrophic cardiomyopathy (HCM) is the most common genetic cardiovascular disorder in athletes and is defined by the Mayo Clinic as “a disease in which the heart muscle becomes thickened” (Mayo Clinic Staff, 2018, para. 1). This usually occurs on the left ventricular wall. “In a large case series of SCD in 1,866 young athletes, HCM was the causative condition identified in nearly 40% of cases” (Malhotra & Sharma, 2017, p. 80). Many athletes with HCM go undiagnosed and discover their condition after it is too late. “Unfortunately, over 80% of affected individuals are asymptomatic before SCD” (Malhotra & Sharma, 2017, p. 80). Hypertrophic cardiomyopathy occurs at a higher rate in athletes because they have a larger cardiac output and a greater oxygen demand than non-athletes. This increased demand on the heart can exacerbate the symptoms of HCM, leading to sudden cardiac arrest. Despite genetic predispositions, lifestyle factors such as diet, illnesses, substance abuse, medical interventions, and stress, can play a role in the development of cardiac conditions in athletes (Rowlett et al., 2021).

The impact of popular trends and fads in society can have an influence on adolescents and young athletes. College athletes are in a phase of development and turn to their peers and popular culture for guidance. A particular trend that seems to be popular among young adults is the use of vaping devices and e-cigarettes. “In 2019, over 5 million middle and high school students used e-cigarettes – an alarming increase of nearly 3 million more students in two years” (Cofer et al., 2021, p. 1). Vaping or the use of e-cigarettes is associated with negative effects on the cardiac system. The large number of young individuals who use and are addicted to these devices is worrying, and further research into health conflicts should be investigated. Tsai et al (2020) conducted a review of literature on the acute and chronic effects of vaping devices and e-cigarettes on cardiovascular and pulmonary functions. The study used human subjects for the short-term effects and

animal studies for the long-term effects, as the long-term exposure to vaping on humans is yet unknown. The study found that “acute exposure to e-cigarette aerosols in human subjects led to increased blood pressure and heart rate” and “Chronic exposure to e-cigarette aerosols using animal models caused increased arterial stiffness, vascular endothelial changes, increased angiogenesis, cardiorenal fibrosis, and increased atherosclerotic plaque formation” (Tsai et al., 2020, p. 5039).

Vaping devices are considered to be a healthier alternative to smoking cigarettes; however, the chemical profile of vapes still appears to be dangerous. “E-cigarette aerosols have been found to contain harmful substances including heavy metals, volatile organic compounds and cancer-causing chemicals” (Tsai et al., 2020, p. 5040). The surge in young athletes’ cardiac repercussions may be caused by these acute and chronic consequences of vaping products, which are most likely triggered by the inhalation of such toxicants. “Health effects of e-cigarettes may potentially be more diverse and detrimental than those caused by conventional tobacco, given the numerous chemicals within vaping aerosols and the interactions that are occurring amongst them, and the current lack of methods for capturing the broad range of variables at play (device type, flavorants, wattage, puff duration, etc.)” (Tsai et al., 2020, p. 5050). This data suggests that vaping and using e-cigarettes causes acute and chronic alterations in cardiopulmonary physiology that may lead to serious cardiac complications. Therefore, it is crucial to investigate further research on the exposure of these devices and to prioritize limiting e-cigarette use among teenagers and adolescents.

Performance-enhancing substances can be noticed as trends in various athlete communities, but unfortunately, they can be misused and become addictive. Not only does the abuse of substances lead to potential disqualification in competitive sports, it can also have some serious health consequences. One of the most harmful and popular substances is anabolic-androgenic steroids (AAS). The typical adverse effects of AAS affect major organ systems with detriments such as cardiac toxicity and lipid abnormalities (Dhar et al., 2005). These substances contain synthetic hormones that mimic the effects of testosterone and have been linked to cardiovascular problems. “Though statistics show that less teens are using anabolic steroids, they represent over 75% of steroid users overall” (Witmer, 2021, para. 1). Elite athletes and celebrities who

publicly use steroids, like Arnold Schwarzenegger, may have an influence on young adults and teenagers (Stephanopoulos, 2005). Nonetheless, anabolic steroids can be incredibly dangerous and can put athletes at an increased risk of sudden cardiac death. Anabolic steroids have frequently been demonstrated to develop left ventricular hypertrophy, hypertension, hyperchloremia, and structural changes to ventricle walls, which leads to an increased risk of myocardial infarction (Dhar et al., 2005).

Stimulants are widely used in sports, and some in particular may be associated with cardiac events. Ephedra, a natural stimulant derived from the ephedra plant, is commonly used to boost performance, and promote weight loss (Dhar et al., 2005). Athletes seem to be attracted to taking ephedra due to its perceived benefits of increased energy and decreased exhaustion time. However, it has been associated with influencing cardiac abnormalities. “Hypertension was the most frequent adverse event, followed by palpitations, tachycardia, or both. Sudden death was reported more frequently than myocardial infarction or arrhythmia” (Haller & Benowitz, 2000, p. 1834). The use of ephedra-containing supplements led to numerous cases of serious adverse events, including fatalities, which ultimately led to the FDA banning such products in 2004. It is crucial to prioritize the health and safety of athletes over winning. Education and awareness campaigns should be implemented in the sporting world to discourage the use of performance-enhancing substances and explain the potential cardiac problems they may cause.

Energy drinks are favored among the younger culture and even more so by collegiate athletes. On a daily basis, college athletes can become overwhelmed by the demands of balancing their assignments, classes, training sessions, games, and work. Therefore, it is incredibly common for individuals to rely on the boost of energy drinks. These carbonated drinks are marketed as a quick and satisfying way to boost energy levels, enhance performance, and improve cognitive function. It is important to identify the components of an energy drink and how it can affect the body if consumption is excessive. Some energy drinks contain an immoderate amount of caffeine, sugar, and other stimulants that cause the heart to beat faster and harder which could have unpropitious effects on the cardiac system. “In general, these drinks have been shown to increase heart rate, blood pressure, and arrhythmias (including atrial

fibrillation)” (Rowlett et al., 2021, p. 347). People who are sensitive to caffeine or who have underlying heart conditions can be particularly susceptible to cardiac issues; therefore, intake should be moderately evaluated as cases of sudden cardiac death have been reported after consumption of energy drinks (Enriquez & Frankel, 2017).

Additionally, mixing energy drinks with alcohol can be especially dangerous as many arrhythmia cases secondary to energy drink consumption were due to excessive intake over a short period of time or co-ingestion with alcohol or other stimulants (Wassef et al., 2017). Athletes are recommended to prioritize hydration, nutrient-dense foods, and proper sleep for optimal performance rather than relying on energy drinks. Young athletes should consult with qualified healthcare professionals or nutritionists to develop a unique dietary plan that meets their needs and goals to be successful collegiate athletes.

Another significant factor that may contribute to heart abnormalities is chronic stress. Stress is known to have a direct effect on the heart and cardiovascular system. According to the American Institute of Stress, “77 percent of people experience stress that affects their physical health” (Patterson, 2022, para. 3). The pressure for collegiate athletes to succeed in their sports and academic responsibilities can be a major source of stress, not to mention injuries and other setbacks that may occur. “An NCAA study found 30% of surveyed athletes feeling extremely overwhelmed, with nearly 25% feeling mentally exhausted” (Lindberg, 2021, para. 15). The high percentage of young athletes who are chronically stressed and potentially burnt out is a worry for their mental and physical health. Chronic stress is known to increase blood pressure and heart rate but can also lead to more severe cardiac damage. “Chronic stress causes autonomic dysregulation. This shift has been shown to increase the risk of arrhythmias, platelet aggregation, acute coronary syndromes, and heart failure” (Franklin et al., 2021, p. 9924). In addition, chronic stress can lead to unhealthy coping mechanisms, such as over and undereating, smoking, and drinking alcohol, which can further increase the risk of heart disease and abnormalities. These unhealthy habits can lead to internalizing disorders such as depression and anxiety.

Depression and anxiety are not uncommon in collegiate athletes, and they may be at a higher risk of diagnosis

due to such stress. The American College of Sports Medicine states that “Approximately 35% of athletes experience [eating disorders], burnout, depression or anxiety” (American College of Sports Medicine, 2021, para. 3). Both of these psychiatric disorders may lead to changes in the body that increase the risk of heart deficits. Depression and anxiety can increase levels of stress hormones like cortisol, which can cause inflammation in the body and damage the lining of blood vessels. “Major depression highly correlates with subsequent cardiac events. Similar to depression, anxiety is also considered a strong predictor of acute cardiac events in patients with stable coronary disease” (Franklin et al., 2021, p. 9923). Given the repercussions of chronic stress and psychiatric disorders on the cardiac system, it is important for athletes and coaches to prioritize stress management and self-care practices. The incorporation of relaxation techniques, mindfulness practices, and sufficient sleep into collegiate athletes’ routines can benefit their health massively. This can help reduce the risk of cardiovascular problems and other negative health outcomes associated with these ailments.

The COVID-19 pandemic had a significant impact on the lives of many individuals, including the health of young athletes. The sudden rise in cardiac abnormalities in young athletes has raised concerns among medical professionals and researchers about the long-term effects of COVID-19 infection, as well as the safety and efficacy of COVID-19 immunizations (Moulson et al., 2022). The COVID-19 infection has been shown to affect the cardiovascular system in several ways, with the most prominent being myocarditis; inflammation of the heart muscle (Moulson et al., 2022). It has been established that hypertrophic cardiomyopathy (HCM) is linked to athletes, thus it may be possible that myocarditis can exacerbate HCM. “From a cohort study of 1,597 U.S. university competitive athletes following COVID-19 infection, 37 athletes (2.3%) were diagnosed with clinical and subclinical myocarditis” (Maffetone & Laursen, 2022, p. 1). Additionally, it was examined that inflammation of the pericardium and pericarditis had been identified in recently infected patients (Maffetone & Laursen, 2022).

Furthermore, reports of myocardial damage and fatal cardiac conditions in people who have received particularly the mRNA vaccines, raise concerns about the effectiveness and long-term implications of the COVID-19 vaccination. There appears to be an increased incidence of myocarditis in the athlete population, specifically in males, after receiving the

mRNA vaccines (Moulson et al., 2022). A national passive surveillance report in the United States found that athletes who received the SARS-CoV-2 vaccine had increased myocarditis sign rates within 7 days of the first vaccination, which peaked after the second vaccination dose in adolescent males and young men (Maffetone & Laursen, 2022). The exact mechanisms of myocardial injury after COVID-19 vaccination are not well understood and are thought to be an immune response triggered by the vaccine.

The immune-mediated side effects are shown to reverse the original goal of the vaccine and cause inflammation in the heart muscle (myocarditis) or in the lining of the heart (pericarditis). Theoretically, vaccines that use the same antigen as the SARS-CoV-2 spike protein could involve the production of secondary anti-idiotypic (Ab2) antibodies (Murphy & Longo, 2021). “These can bind to and deplete the initial protective antibody responses, mirroring the original antigen, and potentially lead to adverse immune, cardiac, and neurologic side-effects, including long-COVID” (Maffetone & Laursen, 2022, p. 2). Although the incidence of myocardial injury from immunizations is noted as rare, the data on COVID-19 infection and vaccinations are not separated into variables and whether the illness or the vaccine has influenced cardiac abnormalities is unknown to date. Therefore, it is crucial to continue monitoring and reporting any adverse cardiac effects to thoroughly investigate the causes of the COVID-19 infection and the safety and efficacy of the vaccination.

Based on the significant variables that have been shown to interfere with cardiac irregularities in young athletes, it is highly crucial for entities to be adequately equipped and educated in anticipation of a cardiac episode. Prior to participation in sports, all athletes should undergo pre-participation screenings to identify any pre-existing cardiac conditions that may pose a risk (Petek & Baggish, 2020). Given the increased prevalence of heart ailments among young athletes, these screenings should involve a comprehensive medical history and physical examination, as well as an electrocardiogram (ECG) and possibly additional cardiac imaging tests.

Athletes, coaches, and trainers should be educated about the warning signs and symptoms of cardiac issues, such as chest pain, shortness of breath, and palpitations. They should also be trained in basic life support (BLS) and cardiopulmonary resuscitation (CPR). Access to automated external defibrillators (AEDs) at sports venues and games should be prioritized as

they potentially make the difference between life and death. “The widespread availability of external cardiac defibrillators has contributed to increased survivability of SCD events. The interval between arrest and defibrillation is the single biggest contributor to survival” (Rowlett et al., 2021, p. 350). Due to the rise in cases of sudden cardiac deaths in young athletes and the lack of certainty regarding the underlying cause, it is recommended that athletes with known and unknown cardiac conditions have regular follow-up visits with a cardiologist to ensure their safety.

The increasing incidence of cardiac abnormalities in young athletes is a serious concern. Cardiac irregularities are one of the leading causes of SCD which is seen in a variety of sporting athletes. Various factors such as diet, illnesses, substance abuse, medical interventions, chronic stress, and mental illnesses are considered when evaluating the strike in cardiac abnormalities and mortality in this population. Inherited heart malformations can be prevalent in athletes with the most frequent genetic disease being hypertrophic cardiomyopathy (HCM). Some athletes are asymptomatic hence why it is crucial to undergo medical evaluations. The use of vaping and e-cigarettes was seen to cause a surge in young athlete’s cardiac repercussions that are caused by acute and chronic consequences of vaping products (Tsai et al., 2020). Some of these consequences lead to abnormalities like arterial stiffness, high blood pressure, and vascular endothelial changes.

Many young athletes use performance-enhancing substances to emulate their role models and achieve the desired physique. However, these substances such as anabolic-androgenic steroids and ephedra stimulants were found to lead to cardiac adverse events such as myocardial infarction, hypertension, and arrhythmias (Dhar et al., 2005). Additionally, it was assessed that excessive consumption of energy drinks can lead to unpropitious effects on the cardiac system including arrhythmias, high blood pressure, and cases of sudden cardiac death (Rowlett et al., 2021). Chronic stress was identified as a significant factor in heart abnormalities in young athletes, increasing the risk of coronary syndromes, heart failure, and once again, arrhythmias (Franklin et al., 2021). The prevalence of depression and anxiety, two common struggles among young collegiate athletes, correlated with cardiac conditions and were considered strong predictors of acute cardiac events. The pandemic disrupted the lives of many, which prompted medical experts to examine the COVID-19

virus and found it to affect the cardiovascular system, with myocarditis being the most prominent abnormality (Moulson et al., 2022). The COVID-19 vaccinations were also scrutinized and discovered that cases of myocarditis and pericarditis were immune-mediated effects that occurred seven days after receiving the vaccination (Maffetone & Laursen, 2022).

It can be overwhelming to comprehend the many factors that contribute to the rise of sudden cardiac death among young athletes, but it is essential to be readily prepared. It is crucial to ensure that athletes undergo necessary medical treatments in an effort to lower mortality rates among young athletes. This involves pre-participation screenings, electrocardiogram examinations, and regular check-ups with a cardiologist, as well as having external defibrillators readily available. Exercise has exacerbated underlying cardiac conditions in young athletes, and there is a pressing need for more extensive scientific and medical research to understand why young athletes are suffering from sudden cardiac deaths and why they have increased in the past few years.

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Creating an Inclusive Learning Environment in the Elementary Classroom

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Abstract

Creating an inclusive learning environment facilitates classroom management and implementation of a high-quality education. Attempting to incorporate inclusion in the classroom comes with many challenges for teachers as they strive to meet every student's needs. To minimize the challenges, more professional development programs should become available for educators. In addition, there are many strategies and practices that teachers can apply in their teaching as a guide to increase inclusion in the classroom. In this study, the educator implemented different strategies and practices to create an inclusive learning environment during a week-long content area-focused unit of study in a second-grade classroom. Implementing such strategies fostered an inclusive learning environment, and student participation increased as seen in the assessment scores.

Introduction

The goal of inclusion is to accept students' strengths and weaknesses to help all students succeed. Every student deserves a high-quality education, but to accomplish this, teachers must be prepared to take on the challenge. Not only are inclusive classroom strategies necessary in the classroom, but schools also need strong leaders who believe in the success of all students. Research from neuroscience shows how our brains are "wired to connect" and engage socially with others (Goelman, 2006). Humans seek the need to belong. With the increasing recognition of the influence of social and emotional factors on learning, educational institutions have begun prioritizing the promotion of social inclusion as a key objective in their efforts to cater to the educational requirements of all students (Durlack et al., 2015). Educators play a critical role in students' social experiences in school. As a result, intentional effort should be made to create classrooms that are both socially and academically inclusive.

It is paramount for educators to take part in professional development opportunities to learn how to develop and implement strategies aligned with best research-based

practices to create an inclusive classroom environment to grow all students both academically and socially.

Literature Review

Strategies and Practices

Professional development programs focus on training teachers to create inclusive lesson plans that serve as best practices to create an inclusive environment in the classroom. In addition, teachers must learn the most effective strategies that help them to incorporate an inclusive learning environment.

In Leifler's (2020) research study, various activities were conducted so that teachers understand student needs in the pedagogical, physical, and psychosocial areas. Almost all of the activities and goals were linked to the Praxis to have a balance between theories with which teachers were already familiar (Leifler, 2020). Some pedagogical practices presented during the sessions included appropriate implementation of transitions, and breaks, emphasis on repetition, and setting clear instructions. In the physical area, some strategies included having a retreat room, which is a

special, isolated area where students can take a break, or increasing participation with engagement. Additionally, a calm environment and lesson preparation are noted strategies as well. Finally, in the psychosocial area, teachers were recommended to incorporate student confirmation/validation, positive reinforcement, motivation, relationship building, and a consistent behavior management plan.

McGuire and Meadan's theory (2002) was based on another theory built on the factor that students learn best when there is a relationship between the learner and the environment and a relationship between the environment and themselves. Having the correct strategies and understanding student needs can help a teacher attain a high level of self-efficacy.

Obstacles Faced in Creating an Inclusive Classroom

Unfortunately, many teachers do not receive the outside support they need to meet their students' needs. In one case study, Siron and Mulyono (2017) gathered 31 teachers from 31 different elementary schools to collect data through various interviews.

In reviewing the discussion during the interviews, Siron and Mulyono found several obstacles that teachers encountered when asked about implementing an inclusive learning environment. First, teachers have basic knowledge of what an inclusive classroom should look like and how to implement it (Siron & Mulyono, 2017). This then leads to inappropriate creation of lesson plans because teachers do not incorporate differentiation strategies. Second, classroom management becomes overwhelming for teachers (Siron & Mulyono, 2017). The average classroom size is approximately 18 students per classroom and one teacher. In addition, a teacher is in charge of providing whole group, small group, and individual instruction. If teachers do not have routines and procedures set with their students, then chaos may arise when attempting to meet every student's needs. Furthermore, parents are not involved in their child's education, or they become skeptical that their child needs accommodations or modifications (Siron & Mulyono, 2017).

Teachers are responsible for the learning of all the students as well as having to implement a socially inclusive environment. General educators felt they needed additional professional development to educate

students (McGuire & Meadan, 2022). Inclusive teaching does not only rely on pedagogical practices but also on support and collaboration from special educators and administrators. Schools must be restructured to permit teachers to collaborate with their coworkers and have other resources that serve as primary aid for all teachers (Bargerhuff, 2001). When teachers receive training and support from outside sources, then they will feel more confident and educated when creating a lesson plan to meet the needs of all students.

Professional Development (PD) Programs and Leadership

Researchers agree that there are no programs established for teachers to learn how to appropriately implement an inclusive learning environment (Siron & Mulyono, 2017). Educators admit professional development (PD) programs are a form of support for them in incorporating an inclusive environment.

Leifler (2020) conducted a case study to investigate "the effectiveness of a three-session professional development program based on the lesson study methodology" (p. 221). Throughout the research, there were 26 teachers from 3 different schools that participated in a three-session PD program over 4 months. One goal of this study was to increase the awareness that "one model does not fit all" (Leifler, 2020, p. 223), concerning inclusion in the classroom.

The results were gathered after looking at data from pre/posttests, questionnaires, field notes, and personal teacher attitudes toward the strategies being practiced. After analyzing the results, Leifler (2020) found that teacher readiness, confidence, and openness increased in all areas. After the PD program, teachers included more varied strategies in their teaching. In addition, teachers demonstrated a positive attitude toward working to meet every student's needs in the pedagogical, physical, and psychosocial areas. Not only can this study help teachers create an inclusive environment, but the research can also guide administrators on how to strengthen and support their teachers along the way (Leifler, 2020).

The administration's leadership. Generally, teachers receive a limited amount of support from facilitators and administration (McGuire & Meadan, 2022). Bargerhuff sought to research the relationship between inclusion in schools and those who lead them. The

purpose stated in the article is to examine how principals' leadership qualities influence elementary school inclusion programs (Bargerhuff, 2001). The researcher chose three fully inclusive elementary schools that incorporate inclusive learning strategies to gain a greater understanding of how principals implement and influence these strategies among their teachers and students. Bargerhuff (2001) gathered data through observation, semi-structured interviews, document review, and shadowing. In gathering the data, the researcher found some relational attributes among the principals that made inclusion successful in their schools. These attributes were caring, courageous, intuitive, visionary, and collaborative (Bargerhuff, 2001). Furthermore, the principals exemplified several common characteristics such as excitement, promoting growth for all, providing emotional support, making time to listen, being honest and straightforward, and attending to their personal values and morals. To have an inclusive environment, teachers must be led by a strong administration that cares and seeks the success of all students.

Summary and Conclusions

Teachers play a vital role in student success, so teachers need to be fully equipped to provide students with the best learning process. If teachers are exposed to training designed to support them in the lesson planning process, then teachers become more comfortable with providing every student with a high-quality education. As teachers become more aware of the obstacles that teachers face in incorporating an inclusive environment, they can then overcome the challenges by adopting professional development programs that guide them in creating strong lessons, and educators can learn more about effective teaching strategies to apply in their classrooms.

Methods

Sixteen students in a 2nd-grade elementary classroom between the ages of 7 and 8 participated in the research. The class consisted of eight girls and eight boys. Ten students received accommodations such as modified assignments/tests, repeated directions, extended time, and small group assessments. Fifty percent of the students were white, and fifty percent of the students were Hispanic. According to state records, the school's overall student assessment report card score is a B. The

educator who created and implemented a week-long content area unit of study was a pre-service teacher in the final year of residency. The unit of study aligned with both science standards related to animal adaptations and reading standards aligned with research-based literacy vocabulary, writing, and reading strategies.

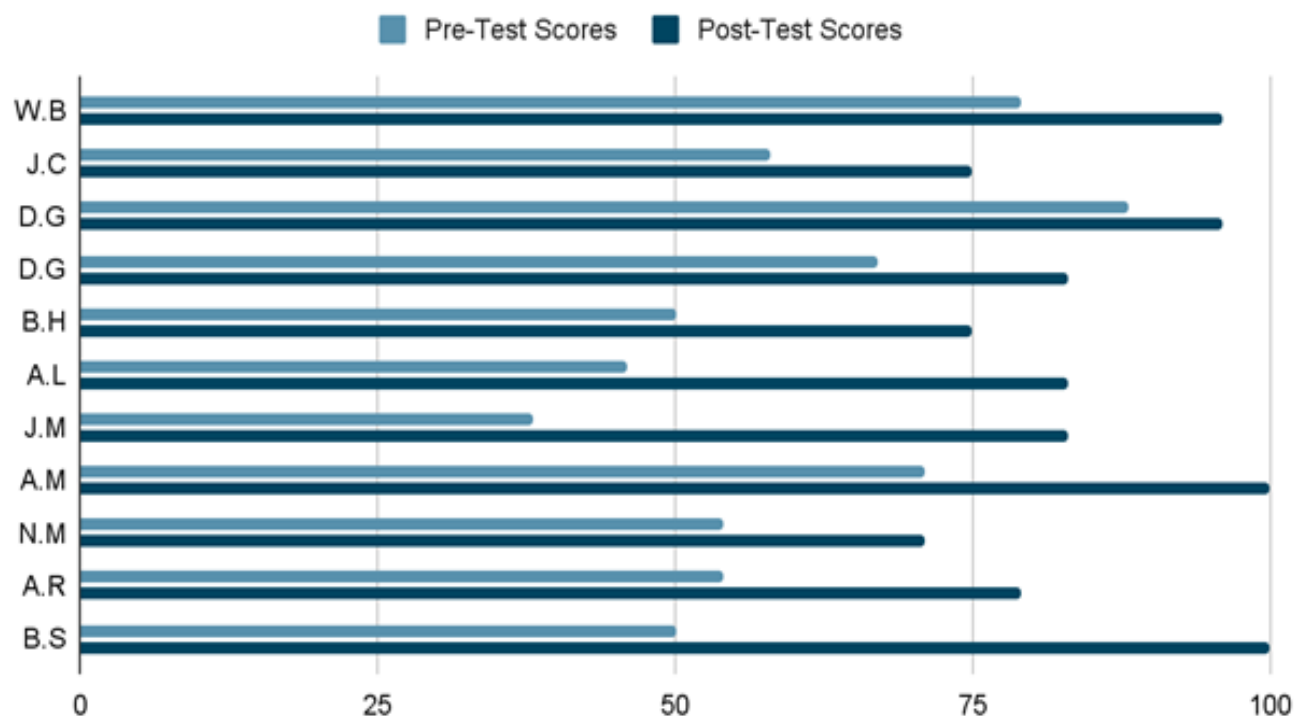
Before implementing the content area literacy-focused unit plan, three sets of assessment data were reviewed for each student within the class: Independent Reading Level Assessment (IRLA) at the end of the 2021-2022 school year, IRLA at the beginning of the 2022-2023 school year, and Standard Test for Assessment of Reading (STAR). In addition, both a cultural and learning styles inventory were administered to each student in the class. State records were reviewed to obtain an understanding of school-wide performance assessment scores. The data gathered before the planning and implementation of the content area literacy unit plan guided the instructional design of the unit. An emphasis was placed on creating an inclusive learning environment in the classroom. These practices included teacher preparation, clear instructions, student engagement, and relationship building. The same pre and post-tests were administered before and after the implementation of the week-long content area literacy unit plan. In addition, student progress was tracked related to mastery of the unit standards throughout the week.

Results

The average post-test score of the class was 86 percent, with 100 percent of the students making gains in comparison to the pre-test. All students achieved mastery of the content. Mastery is defined with a score of 75 percent or greater on the post-test. The main impact on student learning came from presenting instructional content, which related to how the teacher delivered content while creating an inclusive learning environment for all students. Mastery of the content was achieved by gathering data, administering inventories, and building relationships with the students to plan the unit accordingly. The conclusion can be drawn that teacher preparation and effective implementation of inclusion practices throughout the week-long content area unit plan increased student achievement.

Figure 1.1

Individual Pre/Post Test Scores



Conclusions and Implications for Further Research

Professional development programs, student-teacher relationship building, and presenting instructional content all help create an inclusive environment in the classroom. Educators must differentiate their teaching using different pedagogical practices to find what works best for their students. More research can be done to investigate how grouping students in the classroom can help increase inclusion. Such grouping can focus on seating arrangements, partner grouping, and/or individual grouping for students learning at a higher level. Different grouping strategies can be factors that can be considered for further research.

Based upon both the literature reviewed and the results of this action research study, the conclusion can be drawn that creating an inclusive environment in the classroom requires teacher preparation, both from professional development programs and content knowledge, relationship building with the students to know their strengths and weaknesses, and a strong

lesson that contains clear instructions and sustains students' engagement. Teachers seek to find the key to providing every student with a high-quality education. As teachers learn how to avoid and overcome the challenges they face, they will then be able to create an inclusive learning environment for all students in the classroom.

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Best Practices of Creating Feedback Loops Through Strategic Questioning During Classroom Instruction

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Abstract

One of the most impactful tools teachers have at their disposal when teaching a lesson is the practice of intentional questioning. Through various qualitative research studies, it has been repeatedly determined that the intentional usage of meaningful questioning styles yields higher performance rates than closed-ended questions. By using specific questions, teachers can direct the lesson to the intended topic and promote critical thinking while formatively tracking students' progress toward mastery. By scaffolding questions in an open-ended format, teachers can create feedback loops during class discussions. When teachers ask questions that promote detailed and complex thinking, students are pushed to reach a higher order of thinking and dig deeper to determine an answer as opposed to a simple yes or no. Qualitative research conducted by various researchers was reviewed. It was determined in each study that questioning styles are impactful for students' growth of critical thinking and the production of feedback loops.

Introduction

Strategic questioning serves multiple benefits and purposes within the classroom setting. It prompts critical thinking, evaluates student comprehension, presents information, stimulates discussion, and fosters the development of critical thinking skills (Marangell, 2021). It is also important to note that the type of question a teacher asks is dependent upon the purpose for asking (Marangell, 2021). In other words, what is the teacher trying to accomplish by asking this question?

Strategic questioning by teachers can effectively prompt student thinking. This can be done by posing a hypothetical question with no clear, immediate answer. Students will hypothesize and consider what they believe the answer could be. By asking this type of question, the students start to engage and consider possibilities.

Teachers can use questioning as an assessment tool to track students' progress toward mastery of the skill or concept. This may include questions such as, "Can you give me an example of..." or, "What can you tell me about...". If students are unable to answer questions in this form, they may need more practice (Marangell, 2021).

By intentionally asking a question, a teacher can convey information that he/she wants others in the class to know. An example of this would be calling on a student who understands the lesson so that his/her peers will benefit from his/her response to the question. Information is often retained when it comes from a peer. They may listen to a student explain how he/she solved a math problem, which may ignite an ah-ha moment.

Marangell (2021) stated that discussions can be a byproduct of questioning. A teacher poses a question, a student answers, and another student responds after

hearing what student one said. When students begin discourse back and forth about the question that was posed, a discussion has been sparked in the classroom that can go in any direction the teacher takes it. If no students respond, wait, rephrase the question, or try a closed-choice question. If the same student responds to every question, a teacher can say, "I would like to hear from somebody at this table" or "Who can build from that?" (Marangell, 2021).

Different questioning styles can facilitate critical thinking in students. A specific question may promote different levels of thinking depending on students' prior knowledge, the complexity of the question, and the context in which it is presented (Marangell, 2021). By paying attention to the wording or style of the question, a student may reach a higher level of Bloom's Taxonomy throughout the discussion.

Using deliberate questioning techniques can have a significant impact within the classroom setting. By asking questions that promote discussion, encourage critical thinking, and assess student knowledge, teachers can form feedback loops during lessons.

Literature Review

Feedback Loops

To launch an investigation into short-term and long-term feedback loops as they pertain to theory and practice in the real world, four Chinese students named Alicia, Candice, Eva, and Philippa (pseudonyms) each conducted individual case studies. Throughout these case studies, each student conducted eight interviews at regular intervals over five years. The goal was to analyze how students were responding to different feedback processes. The four students were asked to report short-term and longer-term attempts at using various feedback processes to see which methods impacted student interviews the most. These interviews were documented and transcribed for the reader's convenience (Carless, 2019).

Carless (2019) hypothesized that feedback loops would not have a direct connection to student uptake and discussions. After conducting this case study for five years, the students found that encouraging student uptake and feedback loops is facilitated by assessment and feedback as key parts of curriculum design (Carless, 2019). When objectives are designed to build on prior knowledge, students are likelier to build upon the

concepts they already know to promote discussion and feedback loops. It has been determined that feedback loops are complex and effective (Carless, 2019). The closing of a feedback loop will rarely be indicative of fruitful, independent student learning.

Intentional Questioning

In addition to feedback loops, intentional questioning techniques have also demonstrated efficacy in enhancing student engagement. When analyzing differences between two kindergarten teachers, Carlile (2019) was able to see how each teacher engaged students in questioning during read-aloud time and which strategies yielded the best results. Each teacher was identified as a "model teacher" by his/her principal based on an unspecified criterion.

While collecting data, a survey was administered to both teachers to determine pedagogical beliefs about read-aloud practices and strategies to determine the opinions of each teacher. Video recordings were also conducted of read-alouds completed in each teacher's classroom. A brief interview with each teacher was conducted after the read-aloud to allow teachers to reflect on their lessons to determine what practices teachers found to be successful or what they wished they could have changed (Carlile, 2019).

The results indicated that each teacher planned instruction differently. Each teacher also had different opinions on what promoted a successful read-aloud in the classroom. It was determined that read-alouds and the role of questioning had a direct result on the number of questions students asked and the feedback teachers got from their students (Carlile, 2019). The more questions the teacher asked, the further the students were pushed to discuss and broaden their understanding of the text.

To understand the strategies and techniques used by exemplary teachers, Rido (2017) developed a qualitative approach to the study of questioning strategies used by master teachers in the classroom. The purpose of the study was to identify the questioning strategies used by exemplary teachers and to determine the impact the strategies have on student performance (Rido, 2017).

To conduct this study, three teachers who were deemed "exemplary" were selected based on their education, mastery of content knowledge, ten years of teaching experience, and recommendations from school

authorities. Each teacher was from a different school and taught a combined total of 100 students who also took part in the study. Data was collected through observations, video recordings, and interviews with the teachers and their students (Rido, 2017). Each of the teachers was observed during his/her regular instructional time. The questioning style of the teacher was documented and video recorded to refer to as needed. The teacher was later questioned about their lesson and was given the chance to explain why they used a particular strategy, and what their goal was when incorporating it into the lesson. Students were interviewed as well and answered questions about their teacher's questioning strategies. They discussed what they liked or disliked about the questioning and whether they found it to be helpful in their learning (Rido, 2017).

After the study was complete, it was determined that a variety of questioning styles and techniques proved to be beneficial to student learning. Students scored higher on assessments and expressed that they enjoyed the classes more in comparison to classes where these strategies were not used (Rido, 2017). Rido (2017) explained that questioning is very important in the language classroom, as it is a tool for interactive learning.

A similar study was conducted in Tennessee, USA to determine which questioning strategies yielded the highest results in mathematics. Two teachers were interviewed and observed during their instructional time. Through these observations, it was determined that open-ended questions that promoted critical thinking proved most beneficial for students (McCarthy, 2016).

Both teachers were videotaped for six months and interviewed after their lessons. During these interviews, teachers were asked why they asked specific questions, why they worded things the way they did, and what impact this seemed to have on their students. While conducting the study, researchers discovered that the teacher with the highest student performance rate used intentional strategies during his/her lessons. The strategies that proved most effective were probing and follow-up, leading, check-listing, and student-specific questioning (McCarthy, 2016). When open-ended questions are used, the atmosphere in the room becomes more complex, and critical thinking is ignited. To be successful in this, teachers must be intentional in their approach.

As the study concluded, it was determined that

teachers who question intentionally and utilize various techniques to promote critical thinking, see benefits such as knowledge, comprehension, analysis, synthesis, and evaluation. These teachers are better able to discern the range of students' thinking (McCarthy, 2016). It was also noted that a side benefit of the study was the interviews conducted with each teacher caused them to become more mindful of their intent behind questioning strategies. As the study continued, teachers became more intentional in their questioning and yielded higher results in student achievement.

It has been determined by each case study that students benefit the most from questioning styles that are intentional and purposeful during instructional time. Students of teachers who ask open-ended questions, promote critical thinking, and ask questions that require higher-order thinking tend to have higher performance (McCarthy, 2016). By being purposeful in questioning, teachers can greatly improve the quality of their lessons.

Conclusion

Teachers wield one of the most influential tools in their educational arsenal: intentional questioning. Numerous qualitative research studies have consistently shown that the deliberate use of meaningful questioning styles outperforms closed-ended inquiries. Through targeted questioning, educators steer lessons toward desired topics, fostering critical thinking and continuously assessing students' progress toward mastery. Open-ended questioning scaffolds class discussions, creating valuable feedback loops. By posing inquiries that necessitate detailed and intricate responses, teachers propel students towards higher-order thinking, encouraging deeper exploration beyond mere yes or no answers. This conclusion emerged from a comprehensive review of qualitative research by various scholars, underscoring the significant role of questioning styles in nurturing critical thinking and fostering feedback loops among students.

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Under the Knife: Victorian Medicine and Public Perception

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The whites of thirty pairs of eyes widened with anticipation. The surgeon's feet shuffled against small piles of sawdust sprinkled about the floor of the operating theater as he began spraying a cloud of antiseptic around the bodies. He coughed and quickly wiped another man's blood from his amputation saw with a swipe of his bare hand. Onlooking, the crowd recoiled as sorry soul reclined on the operation table clenched his fists and let out a deafening screech. Only a man with a saw halfway between his skin and bones could release such a sound. Thirty scratching pens and the drop of six pounds of flesh and bone hitting the dusty floor echoed against the crusted walls and out on to the streets of London.¹

The nineteenth century in Britain was marked by exponential expansion of medical science, which brought with it innovations in fields like microscopy, preventative medicine, and microbiology. Discoveries made during the 1800s, particularly in Europe and the United States, established a foundation for greater credibility in the medical field and set precedents for medical education and procedures, some of which remain standard practice in twenty-first century hospitals. Although the Victorians revolutionized medicine and surgery through innovations in technology, germ theory, and preventative protocols, experimental medicine, medical education, and quackery created an environment of severe patient trauma and horrified imagination around surgery, and medicine at large, for much of the nineteenth century.

The mysterious nature of surgery in early nineteenth century urban British society, elusive and plagued with misinformation and misconceptions, painted an unsettling image for patients and families. Pseudoscience panaceas and medical quackery overtook nineteenth-century consciousness, vending strange products,



"Victorian Newspaper Adverts." Alamy. Accessed April 4, 2023.
<https://www.alamy.com/page-of-victorian-newspaper-adverts-the-graphic-1884-image243042034.html>.

¹ Lindsey Fitzharris, *The Butchering Art*. Penguin Books Ltd, 2018, 4.

ranging from electropathic battery belts to cod liver oil, and profiting from fear. Often propagated through newspaper advertising, false cure-all medicines offered solutions to illnesses for patients who mistrusted medical institutions, wanted a pain-free experience, or simply feared the hospital environment for its marked association with death. Anxiety surrounding hospitals presented itself among surgeons and physicians as well, as some refused to operate within them at all, due to the astronomical dangers of contagion and infection to themselves. Advertising, “the great vehicle for the age,”² was a highly effective avenue for such panacea peddlers and contributed to popular confusion surrounding efficacy in medicine, while also providing a preferable alternative to almost certain death in a public hospital.

Dr. Charles Locock was one of many experimental physicians to take advantage of Victorian advertising. Publishing advertisements in newspapers, magazines, and novels, Locock sold “Pulmonic wafers” which he and his followers claimed were capable of curing nearly every common ailment “of the chest” from fevers to asthma.³ The product’s appeal and claims were tied exclusively to Locock and his reputation as a famous obstetrician and Queen Victoria’s first physician accoucheur (male midwife) in 1840.⁴

Instead of relying on advertisements to get the word out to others in the field, physicians during the Victorian period typically published their professional findings in a medical journal, *The Lancet*. Founded in 1823 and named after a surgical tool, *The Lancet* proved to be an efficient line of communication by which physicians and surgeons could keep abreast of the latest literature—innovations in microscopy, surgical technique, and even antiseptic treatments—allowing for greater volumes of published findings and peer experiment repetition.⁵ New findings were debated, and professionals communicated findings and treatments efficiently among physicians and surgeons in a wide variety of specialties. However, the public not involved in medical practice would more likely pick up a copy of the latest *Times* before a copy of *The Lancet*, because much of the information provided within the journal was often indecipherably niche,

containing medical-specific jargon, which would not have been particularly accessible to the average reader, especially those without university-level education. News and media contributed significantly to popular opinion in all spheres of life from politics and foreign affairs to science and technology. Images, especially with widespread availability of printed media, were central for swaying opinion among all classes of Britons, but especially those who were uneducated. This media landscape rendered the working class particularly ignorant of new findings, and rather ingrained within it a largely avoidant or negative perception of bodily-invasive methods of treatment, experimental medicine, and the hospital environment.

Despite inaccessibility to accurate information among the working class, educated Victorian perspectives were highly influenced by various forms of false or embellished print media, including fictional books. Nineteenth-century fiction brought with it an influx of socially representative novels, thereby contributing significantly to popular discourse in a revolutionarily broad way. From complex symbolism to conspiracy theories about authors and characters based solely on imaginary scenes, stories evolved to represent life so closely that they mirrored, voiced, and amplified anxieties already present within the zeitgeist. However, the “gap between a real patient and a written account of that patient [was] necessarily biased, incomplete, and riddled with assumptions...” making written works about patient experiences into experiments in warped realism, particularly vis-à-vis the human body as a physical manifestation of vulnerability, scandal, and pain.⁶ For example, Charlotte Brontë’s *Jane Eyre* was one such work upon which literary experts and casual readers alike extra-canonically speculated, specifically relating to various conspiracies about alleged mental disorders due to strange behavioral traits, outside of the social norm.⁷ From evidence of popular diagnoses in fictional characters, Victorians could participate in what they perceived were a rational exercises in psychoanalysis or phrenology (a pseudo-science studying facial and bodily features to make medical, mental, or racialized determinations) via fiction, rather

² Louise Penner and Tabitha Sparks. *Victorian Medicine and Popular Culture*. (Pittsburgh: University of Pittsburgh Press, 2021), 9.

³ Penner and Sparks, *Victorian Medicine and Popular Culture*, 10.

⁴ Penner and Sparks, *Victorian Medicine and Popular Culture*, 10.

⁵ “The Lancet.” <https://www.thelancet.com/>.

⁶ Penner and Sparks, *Victorian Medicine and Popular Culture*, 138.

⁷ Nargess Arab, “Jane Eyre: Victorian Women’s Madness Maze.” (Handle Proxy, March 26, 2018).

than confront the serious challenges facing public health as industrialization crept across Europe. Effectively, Victorian-era readers “rationalized the imaginative until it resembled diagnostic criteria.”⁸ Similar analytical processes characterized observations made from reading fiction, flipping through a newspaper, or watching a loved one die in a hospital, all of which required rationalization to some extent.



Hogarth, William. “Marriage A-La-Mode, Plate III.”
London, UK, 1833.

The Metropolitan Museum of Art. New York, USA.

Further contributing to the Victorian habit of rationalizing the unknown, many patients found ways to avoid the hospital environment altogether because of its association with death and the terrifying nature of patient experience within. This avoidance promoted a feedback loop whereby limited extreme experiences provoked fearful imaginings and avoidance. Various factors contributed to popular resistance to medicine in the Victorian period, but many reservations and anxieties revolved around bodily harm in surgery or otherwise and perception of the looming, ubiquitous nature of death. Patient experience during the nineteenth century could be extraordinarily painful and horrifically dangerous, even for the smallest procedures. Physician Thomas Parcival advised his students to change their aprons

and clean their operating tables, not for any hygienic purpose, but “to avoid ‘everything that may incite terror.’”⁹ Medical students were trained to be as efficient as possible, and taking extra time to clean an operating table would only be useful to make the procedure go as swiftly as possible, with little patient interference. Some patients chose to undergo mesmerism, a hypnotic pseudo-science treatment, before procedures, especially before widespread application of ether, a pain-reducing gas administered before an operation. Ether was not introduced as a surgical anesthetic until 1842.¹⁰ Surgeons and physicians practiced limited pre-operative medicine and post-operation care for efficiency in the grimy, cramped, disease-ridden Victorian hospital environment, inducing a gamble for survival for physicians and patients alike. Physicians and surgeons at the beginning of the nineteenth century did not regularly sanitize tools, equipment, or their own bare, ungloved hands between patients. The looming ghost of preventable death cast a shadow on public opinion and made the profession of medicine, and the lesser trade of surgery, darkly dangerous and mysteriously deadly.

Institutionalized medical education further exacerbated fears concerning the ever-present nature of death in the profession. Illegal corpse collection for anatomy studies prevailed over medical and surgical schools, particularly as demand for physicians and surgeons increased, proving to be exponentially more terrifying than medicine itself. In the early decades of the nineteenth century, only bodies obtained from hanged murderers could be legally used for dissection in medical institutions.¹¹ The judgement reflected popular religiosity and rational thought, but the limitation left a gaping hole in the “market” for bodies, quickly filled by “body snatchers.” Institutions of medical education were effectively constructed in the nineteenth century on a secretive underground practice of gravesite corpse robbery, in which paid “resurrectionists” illegally unearthed freshly buried bodies from cemeteries for use in medical school cadaver practice.¹² Bodysnatching was distinct from graverobbing in the sense that stealing material items found at a gravesite was not the main objective, but rather the body itself was the valuable commodity. It was terrifyingly common, with

⁸ Penner and Sparks, *Victorian Medicine and Popular Culture*, 138.

⁹ Fitzharris, *The Butchering Art*, 5.

¹⁰ J. T. Connor, “The Victorian Revolution in Surgery.” (*Science* 304, no. 5667, 2004), 54. <https://doi.org/10.1126/science.1092361>.

¹¹ Fitzharris, *The Butchering Art*, 95.

¹² Fitzharris, *The Butchering Art*, 95.

even the top medical schools, such as Yale medical school in the United States and many schools in Britain, stealing bodies for practice. While the Anatomy Act of 1832 legalized cadaver operation on donated bodies for professionals and students, the simultaneous growing demand for bodies and escalating mistrust of the institution of medical education, resulted in a huge demand for stolen bodies, as religious fervor prevented many from donating family corpses to science.¹³ Bodysnatching contributed significantly to a cyclical reaction of inducing and perpetuating fear of the medical community at large. The Victorians held a fierce obsession with death and the religiosity surrounding it, and as a result, anxious families developed new ways around the dangers of being unearthed after death. As a reaction to mounting terror around the fates of their loved one's corpses, many Victorians opted for protective measures for their gravesites, including elaborate cages, "mort safes," used to enclose the casket in a configuration of raised metal bars. Internal locks, another protective mechanism, were also common. For a resurrectionist to open a casket with such a lock, it would typically have to be destroyed, which could mutilate the valuable freshly buried body within, making it unusable for science. Some Victorians opted instead to let the bodies of their loved ones decompose safely in the home, rather than risk a stolen corpse. However, such action could put a family at severe risk of infection from their relative's rotting corpse. Ultimately, the practice of bodysnatching overtook any lingering confidence in medicine for some Victorians, affecting print media especially among the ultra-religious.

At the beginning of the nineteenth century, surgeons could typically be seen wearing black coats, appearing rather like average gentlemen than modern medical experts. Following widespread application of germ theory throughout the mid- to late- Victorian period, doctors and surgeons gradually transitioned from bare hands and suits to the familiar white coat and gloves, which we continue to associate with Western medicine even in the twenty-first century.¹⁴ Manufacturing and design of surgical tools also changed significantly throughout the century, with tools at the outset of the Victorian period made with bone or wooden handles, which proved nearly impossible to sterilize.¹⁵ Surgeons

transitioned to widespread use of antiseptics and steel tools, which could be cleaned thoroughly and efficiently, without trapping disease-causing bacteria. Many of these measures were enacted not only for patient safety and survival, but career longevity for the surgeons and physicians in practice, as many would die in their first years out of medical school from hospital infections or even the smallest mistake during a procedure. A surgeon could put himself at risk of severe infection or death if he accidentally cut his own bare flesh with his extremely sharp tools during a quick operation. Fears and adaptations such as these are well integrated into modern medical practice in the twenty-first century, and though Victorians had not quite cracked the code to modern practices such as sterilization fields and scrubbing in, they did make significant progress towards these ends.

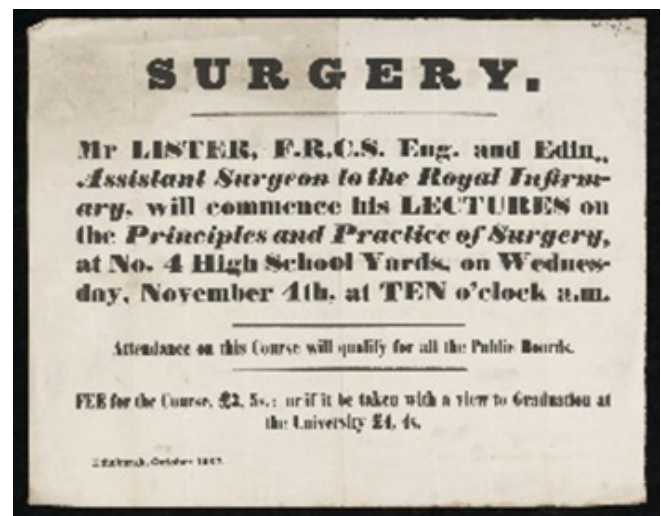


Figure 1. "A Picture of Health" National Portrait Gallery.
Accessed April 3, 2023.

Further accelerating the rate of developments and discoveries in surgery, medical schools commonly required observation sessions of live operations for surgeons and doctors in training. Such observations would take place inside of an operating theater, which was typically comprised of a stage or platform with rows

¹³ The National Archives, "Body Snatchers," The National Archives (The National Archives, June 6, 2022), <https://www.nationalarchives.gov.uk/education/resources/body-snatchers/>.

¹⁴ Fitzharris, *The Butchering Art*, 33.

¹⁵ Fitzharris, *The Butchering Art*, 33.

of seating expanding out from it in nearly all directions, so that medical students could catch every angle of the operation.¹⁶ A surgeon would stand on the platform with his equipment in a portable box, with the patient sitting in a chair or on a table. Students were expected to take notes and ask questions about the procedure to get an accurate idea of the performing surgeon's methods. The floors of these operating theater platforms would typically be sprinkled with a layer of sawdust to soak up extra blood from the patient on the operating table above.¹⁷ Surgeons rarely cleaned tools thoroughly in between patients because it was inefficient compared to rapid-fire amputations, which were considered a skill of a great surgeon because the pain of taking time around the nerves could be brutally painful. Blood from previous patients, the value of efficiency, and a complete lack of preventative medicine in many cases made surgery akin to public torture in the Victorian consciousness, as tens of onlooking medical students could witness patient suffering during any given procedure.

Although medical education operated on objectively strict principles, medical students at Cambridge gained a reputation for rowdiness and drunkenness by the 1840s, getting in more trouble than all other professions combined, according to one account.¹⁸ This behavior was widespread, but particularly became associated with London medical institutions. Institutions simultaneously accepted obscene behavior outside of class as a means of release for overwhelmed medical and surgical pre-professionals and developed more strict policies for conduct in the classroom and residencies at teaching hospitals. Incidents of cadaver mistreatment further plagued medical education.

Emerging from developments in microscopy throughout the eighteenth century and early nineteenth century, germ theory was the microbiological theory that microorganisms could cause disease in the body through processes of infection. This theory upended centuries of assumptions and "discoveries" about medicine, particularly the popular assumptions that invisible gaseous bodies, miasmas, directly caused disease and infection. As microscopes improved with specialized

technology widespread microscope use across Britain, Europe, and the United States, germ theory gained traction and ultimately influenced approaches to treatment and research. By 1825, microscopes acquired the ability to capture microorganisms, thereby providing a means of collecting visual evidence for infections and treatments.¹⁹ Further, visible tracing, replication, and intense study of bacterium and viruses dispelled popular critiques of germ theory, such as the theory of spontaneous generation which suggested that disease propagated spontaneously from previously living organisms.²⁰ Various researchers dedicated their lives to the study of germ theory in the contexts of multiple disciplines, but perhaps the most famous pioneer of germ theory application in preventative medicine was Joseph Lister.



"Joseph Lister." BBC Bitesize. BBC, December 6, 2019.

<https://www.bbc.co.uk/bitesize/topics/zxwxvcw/articles/zkpdri6>.

Born to a well-educated Quaker family in Upton on April 5, 1827, Joseph Lister revolutionized the landscape of professional surgery and medical hygiene with his inventions, public image, and collaboration with others in the field. It is safe to say that Lister's technological and microbiological breakthroughs have saved many lives since their inception and have

¹⁶ Fitzharris, *The Butchering Art*, 33.

¹⁷ Fitzharris, *The Butchering Art*, 5.

¹⁸ Waddington, Keir. "Mayhem and Medical Students: Image, Conduct, and Control in the Victorian and Edwardian London Teaching Hospital", (Social History of Medicine, Volume 15, Issue 1, 2002), 46, <https://doi.org/10.1093/shm/15.1.45>.

¹⁹ Phyllis Allen Richmond, "Some Variant Theories in Opposition to the Germ Theory of Disease." (*Journal of the History of Medicine and Allied Sciences* 9, no. 3, 1954), 290. <https://www.jstor.org/stable/24618980>.

²⁰ Richmond, "Some Variant Theories in Opposition to the Germ Theory of Disease," 290.

changed popular approaches to Western medicine altogether. Lister's father, Joseph Jackson Lister, was a wine merchant and microscopist.²¹ His work involved improving the lenses used on microscopes so that they fulfilled what is commonly known as the Abbe sine condition, which allowed for higher clarity at smaller scales using converging points.²² Lister received his education from Benjamin Abbott's Isaac Brown Academy and University College London Medical School, as he was barred from Oxford and Cambridge for failing to meet their religion requirements. Lister initially studied classics and botany before training in medicine, bringing one of his father's microscopes with him. After completing his required residency at University College Hospital, Lister worked under British surgeon John Eric Erichsen.²³ Lister gained first-hand experience of infectious diseases as a house surgeon, and he witnessed death frequently, whether in the form of patients or fatally infected doctors.²⁴ It was his experiences at University College which showed him "just how much of a lottery surgery was in the 1850s."²⁵ His journal records from this time in his life contain detailed and harrowing observations of localized infections and epidemics within hospitals. His lectures near the beginning of his professional career give special insight into the singular question plaguing the cogs of Lister's ever-churning mind.

He even offered it up to his students:

*It is a common observation that, when some injury is received without the skin being broken, the patient invariably recovers and that without severe illness. On the other hand trouble of the gravest kind is always apt to follow, even in trivial injuries, when a wound of the skin is present. How is this? The man who is able to explain this problem will gain undying fame.*²⁶

Unbeknownst to him at the time, Lister would be one of the pioneers of this question, which consumed his mind for the entirety of his medical career.

Similar to his steadfast pursuit of the answers to his

most curious questions, Lister's image changed very little throughout his life. Lister dressed simply, but respectably, wearing a clean, well-fitted suit nearly every instance he was photographed. Lister was aware that his image was directly attached to public opinion of his work and the work of others in his field. He seems to have been extraordinarily conscious of his image, reflecting his perception of his entire field, which he had to, in some sense, defend to the public amid confusion and constantly changing information. This sense of instability in medicine created a popular sense of anxiety around the field, even as it advanced and gained tangible traction in discovery and innovation. Lister tried to combat some of this anxiety through consciousness about his public image, always serious, scholarly, and unassuming.

Although Joseph Lister pioneered various surgical techniques, especially in abdominal operations, he is most remembered for his work in antiseptic solutions and spraying technology, which he invented as a solution to the pre- and post- operation survival issue plaguing surgeons, doctors, and patients during his training and early years in practice. Lister's device, a spraying machine which evenly distributed antiseptic liquid around an operating area, proved a key element in germ theory development, as well as increasing patient survival rates across various techniques of invasive surgery.²⁷ He also discovered that wrapping incision points in antiseptic-soaked gauze kept the open wounds protected significantly from infection. Because of his inventions, patient survival rates, and new surgical techniques, Queen Victoria's staff inquired Lister to treat an abscess under the queen's arm.²⁸ For this procedure, Lister took a career-defining risk. He decided to try his carbolic antiseptic on Victoria during her operation, spraying it about the room and applying it to his hands and her arm. According to some accounts, Victoria was accidentally sprayed in the face by the royal physician William Jenner who was assisting the operation.²⁹ Lister's successful operation bolstered some popular confidence in Lister's methods, with Victoria effectively

²¹ Fitzharris, *The Butchering Art*, 19.

²² "The Microscope," (Science Museum, accessed May 5, 2023), <https://www.sciencemuseum.org.uk/objects-and-stories/medicine/microscope>.

²³ Paul F. Clark, "Joseph Lister, His Life and Work," (The Scientific Monthly, December 1, 1920).

²⁴ Fitzharris, *The Butchering Art*, 71.

²⁵ Fitzharris, *The Butchering Art*, 71.

²⁶ Fitzharris, *The Butchering Art*, 148.

²⁷ Fitzharris, *The Butchering Art*, 166.

²⁸ Fitzharris, *The Butchering Art*, 210.

giving the “royal stamp of approval” to the antiseptic method.³⁰ Lister’s technology was not without its flaws. Patients complained of eczemic rashes and burning dryness on the skin because of prolonged exposure to the harsh chemicals over the course of long recoveries. Lister’s methods were also confusing for physicians to follow in practice, with his measurements and instructions constantly changing, making it difficult to administer his product effectively and with certainty.³¹

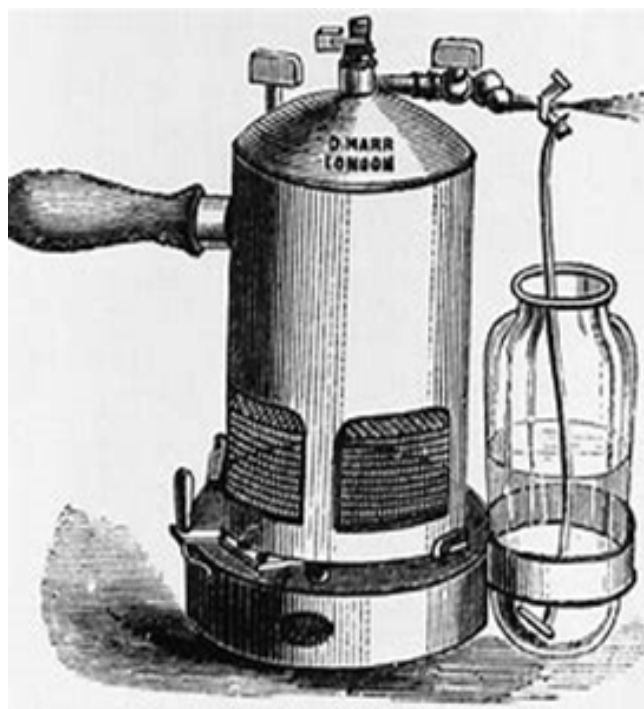


Figure 2 “Lister’s Antiseptic Spray.” Alamy. Accessed April 4, 2023. <https://www.alamy.com/stock-photo-listers-antiseptic-spray-surgery-19th-century-135088432.html>.

Although physicians and instructors had established profitability in medicine before 1800, the mid-nineteenth century marked the rise of voluntary work in hospitals and a shift in focus towards the poor, rather than private education and expensive practice.³² During this period, a clear link formed between hospitals and pedagogical science and exploration. Hospital lectures effectively demolished the preexisting system of apprenticeships,

replacing it with an educational landscape which favored attending lectures from multiple instructors to complete medical training. Evidently, as the educational system evolved, British wealth in scientific knowledge expanded exponentially. By 1815, a common core of classes had been discussed and established, and public lectures drew crowds of prospective physicians and surgeons, particularly in urbanizing London. The nature of public lectures arguably revolutionized pedagogy and experimentation within medicine, but it also allowed for a shift away from privatized, exclusive practice, allowing public health issues to take center stage in the political landscape.

Throughout the nineteenth century, but particularly in the late Victorian period, science and medicine gradually became increasingly politicized, leading to significant polarization in the field. The Anatomy Act of 1832 is such an example, but arguably more significant was the British government’s response to the Cattle Plague of 1865. The response was, perhaps surprisingly, more focused on prevention than developing an effective treatment. A Scientific Committee was formed exclusively for designing the perfect preventative medicine for the cattle affected by the alien illness, but cattle traders and merchants had begun developing cures independently from professional medical opinion. They opted for “vapor baths, bland diets, solutions of belladonna, caustic ammonia, chloroform, turpentine, phosphoric acid, arsenic, and sweetened ale and whiskey,” none of which held much factual merit.³³ The Scientific Committee produced with little better, recommending “a diet of mashed foods, the use of tar acids as a disinfectant, better ventilation, and a higher standard of cleanliness.”³⁴ Despite ineffectual independent treatments, the formation of public entities and organizations proved to be an integral step towards modernizing public health. However, public mistrust of medicine remained blatant, particularly in rural areas for much of the nineteenth century. The 1848 public health act, supported by Poor Law architect Edwin Chadwick, manifested as a response to poor urban

²⁹ Fitzharris, *The Butchering Art*, 210.

³⁰ Fitzharris, *The Butchering Art*, 211.

³¹ Connor, J. T. “The Victorian Revolution in Surgery.” (*Science* 304, no. 5667, 2004), 54. <https://doi.org/10.1126/science.1092361>.

³² Keir Waddington, “A Slow Evolution: Institutionalizing Education.” In *Medical Education at St Bartholomew’s Hospital*, (Boydell & Brewer, 2003). <https://doi.org/10.2307/j.ctvc16kfs>.

³³ T. M. Romano, “The Cattle Plague of 1865 and the Reception of ‘the Germ Theory’ in Mid-Victorian Britain.” (*Journal of the History of Medicine and Allied Sciences*, 1997), 95. <https://doi.org/10.1093/jhmas/52.1.51>.

drainage systems and a cholera outbreak in 1848. The law established a largely ill-functioning Central Board of Health and required additional local boards in areas with particularly high death rates.³⁵ These responses to public health crises display foundational political appreciation for developing science, a factor integral to quelling anxiety around medicines slowly over time.

During the mid- and late- Victorian periods, Germany and the United States rivaled British economic production, particularly in materials such as iron, resulting directly in rapid advancements in the applied sciences.³⁶ Though these efforts abroad were likely inspired by British research, British science itself tended toward theoretical discovery in the late nineteenth century. This focus on the theoretical produced valuable conclusions, many of which could be put into practice years later with proper technology. However, theoretical insights did little to quell apprehension around experimental applied sciences, including medical practice. Ultimately, although the Victorians lead Europe and the world through the industrial revolution, this stagnation in applied science towards the end of the nineteenth century left the British at a distinct disadvantage leading into the twentieth century.

Medical advancements during the Victorian era contributed significantly to curating a modernizing idea of medicine moving into the twentieth century. Although, given the rapidity with which new discoveries were made, public perception of medicine remained largely negative throughout the nineteenth century, as medical advice, practices, and concerns shifted drastically in bursts as new information about anatomy, microscopy, and germ theory was revealed. With the onset and aftermath of the First World War, however, medicine gained a new, more reputable status for its necessity and increased effectiveness. Victorian innovations were built upon throughout the twentieth century, and some of the foundational principles of microscopy, hygiene, and microbiology discovered during the formative years of preventative medicine in the nineteenth century became the rough outline over which twentieth-century physicians, researchers, and surgeons could master precision and detail.

³⁴ Romano, "Cattle Plague of 1865," 95.

³⁵ Hamlin, Christopher, and Sally Sheard. "Revolutions in Public Health: 1848, and 1998?" (*British Medical Journal*, 1998), 587. <http://www.jstor.org/stable/25180245>.

³⁶ Broadberry, Stephen, Rainer Fremdling, and Peter Solar. "An Economic History of Modern Europe: Industry, 1700-1870." (*The Cambridge Economic History of Modern Europe*, 2007).

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