PASSING THE PRAXIS IS AS EASY AS PIE:
PRACTICAL PRACTICE, IMMEDIATE FEEDBACK, AND ENGAGEMENT WITH PEERS

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Abstract

In today's world, Principal Preparation Programs (PPPs) need to be innovative in helping principal candidates be more prepared to lead in changing times, but first, they must receive certification successfully. Completing the Praxis exam is the final requirement to gain certification as an instructional leader in Alabama and is often a stressful time for many. A mixed-methods study was conducted to investigate the problem of principal candidates struggling with the Praxis exam and find ways to support them by utilizing retrieval practice using the theoretical framework of Transfer Appropriate Processing (TAP). An invitation to participate was sent to all students in their last course in the instructional leadership program at one university. Then 30 participants were randomly placed into one of three cohorts: testing, testing with collaboration, or random. Online practice exams were purchased through a small seed grant. Quantitative data consisted of scores from online practice tests at three testing points. A significant difference was found between the practice testing and random groups. Qualitative data from an open-ended survey at the end of the experience revealed that participants increased their confidence and test-taking strategies and found the experience to be positive in preparing for the exam and their future leadership. The implications for PPPs are many, including the importance of providing students with opportunities for retrieval practice and collaboration. This helps not only with the testing situation but also in increasing their ability to transfer knowledge to novel situations similar to what they will face in the complex field of leadership and be better prepared to lead in changing times. Exploring innovative and virtual options for practice and collaboration is also needed for PPPs to meet the needs of online students today and help ensure they are ready to lead schools in times of change.

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Introduction

Research has shown that effective principals are essential in positively impacting the teachers and students in their schools. Principals engaged in exemplary principal preparation programs (PPP) were likelier to be influential leaders, especially during challenging times of change, a part of education today (Darling-Hammond et al., 2022). When a PPP helps candidates understand the complexities of leadership and prepares them to demonstrate knowledge and skills that effective school leaders utilize, they will lead excellently under all circumstances. These skills are also needed to pass the certification exam.

The Praxis Educational Leadership Administration & Supervision (5412) assessment is "designed to measure the extent to which entry-level school leaders demonstrate the standards-relevant knowledge and skills necessary for competent professional practice" (Educational Testing Service, 2022, p. 5). The six content categories of the Praxis (5412) are aligned with the Alabama Standards for Instructional Leaders (ASIL) and the 2015 Professional Standard for Educational Leaders (PSEL).

The Praxis exam is one of the final hurdles for principal candidates seeking Educational/Instructional Leadership certification. For many candidates, the Praxis exam is a routine process, but for others, the challenge is more significant and the process traumatic than the "timed tests" spark fear in their minds. The Praxis exam sometimes stumps those who breezed through coursework with few complications. Therefore, finding effective strategies to aid students in this endeavor is essential. Research studies show that practice exams, as retrieval practice, are one of the best ways to prepare for high-stakes tests (Adesope et al., 2017; Brame & Biel, 2015; Dunlosky et al., 2013; Larsen, 2018; Whiffen & Karpicke, 2017).

Much research exists on the effects of retrieval practice on learning, especially in P12 schools and for undergraduate students in higher education. However, there is a gap in the research on how retrieval practice impacts graduate students, especially those in principal preparation programs preparing specifically for the Praxis exam. This study explores how practice, immediate feedback, and peer engagement impact principal candidates as they prepare for the Praxis exam and become better prepared for *leading in a time of change*.

Theoretical Framework

The theoretical framework guiding this study is Transfer Appropriate Processing (TAP) which explains that memory is determined by the relationship between how information is encoded initially and how it is retrieved later (McDaniel et al., 1978; Morris et al., 1977). TAP is "a theory stating that memory performance is better when the cognitive processes engaged during retrieval match the cognitive processes that were engaged when the material was encoded" (American Psychological Association, n.d.). In this study, TAP is applied by helping students to take their initially encoded information learned in the principal preparation program and to retrieve it through practice tests. In addition, integrating TAP into practical practice, immediate and delayed feedback, and engagement with peers will prepare aspiring leaders to succeed when faced with challenging situations in school leadership, especially as they navigate changing times.

Literature Review

The literature review section of this study explores the theoretical framework of Transfer Appropriate Processing (TAP) and its application to practice testing to improve the retention and transfer of knowledge for principal candidates as they prepare for the Praxis exam. The literature review also delves into the relationship between immediate and delayed feedback and how feedback enhances the testing effect. Additionally, the literature review examines the benefits of collaboration and peer engagement as an effective way to improve learning following retrieval practice. Ultimately, this literature review ties together the theoretical framework of TAP and the practical applications of practice testing, feedback, and collaboration in PPPs and provides the foundation for the study's research questions and methodology.

Practical Practice

Students often view testing as just a part of the educational process and would prefer not; they view it as just a part of the educational process and prefer avoiding them. This is especially true when facing high-stakes summative assessments that have a tremendous impact on their future, such as the Praxis exam, which must be passed to obtain certification to be a school leader. Larsen (2018) argued that educators often give tests to measure knowledge to ensure the learner has achieved at least a minimum level of competency, hoping they will retain this information for the rest of their careers. That is certainly the hope for aspiring leaders in PPPs. Promising evidence has emerged from cognitive psychology and applied education studies that repeated retrieval of information, or practice testing, improves retention significantly (Dunlosky et al., 2013; Larsen, 2018; Tures, 2022). There is some evidence that testing improves student memory of the tested information and related information (Brame & Biel, 2015).

Moreira et al. (2019) suggested that the practice of remembering previously studied information (i.e., retrieval practice) is more advantageous for long-term retention than restudying that same information, a phenomenon often termed "testing effect." When used correctly, retrieval practice techniques help to foster deeper learning and understanding so that the knowledge can be embedded into long-term memory and retrieved to help with future testing and even improve the transfer of knowledge to new contexts, such as the challenges aspiring leaders will face in their role as a school leader (Roediger & Butler, 2011; Roediger et al., 2011; Whiffen & Karpicke, 2017).

Dunlosky et al. (2013) thoroughly synthesized more than 120 studies conducted during a 10-year window. They found that practice testing was a promising technique to help students better regulate their learning and significantly impact the final performance on high-stakes testing. They reported that practice testing improves learning as elaborative retrieval processes are activated when attempting to retrieve information in long-term memory, which helps create multiple, organized pathways to facilitate later access to that information. They rated practice testing as a high-utility technique that has broad applicability. When testing is combined with feedback, learners can use repetition to make corrections and have opportunities to correctly retrieve the information they may have missed before (Larsen, 2018). Effective feedback can be immediately given so students know the rationale for the answers provided after each question. Delayed feedback occurs when students complete the test and then return to see the results and rationales for correct responses.

Immediate and Delayed Feedback

Much research has been conducted on the role of feedback on the testing effect. Feedback provides metacognitive monitoring to ensure accuracy and can lead to shifts from ineffective to effective retrieval strategies (Larsen, 2018). Outcomes of testing with feedback outperformed outcomes of practice testing alone, with one study reporting that student performance was almost double in those who had received feedback following the practice test (Butler & Roediger, 2008; Dunlosky, 2013).

Although retrieval practice increases long-term retention of information, it is enhanced even more when feedback with the correct answer is provided to the test-takers, especially for multiple-choice items, because the incorrect information has also been presented. When a learner gives an incorrect answer but is provided with corrective feedback, researchers have elicited evidence of reconsolidation which reactivates memory and allows it to be updated and more easily accessible in the future (Finn et al., 2012).

Common sense thinking, in addition to studies that have been done in behavioral psychology, indicates that immediate feedback (following each question) after a test is beneficial; however, some research results show delayed feedback (at the end of the test) may be even more helpful (Roediger & Butler, 2011). Wheeler et al. (2003) conducted a study in which students were either given feedback immediately or delayed feedback. Results indicated that students who were provided immediate feedback increased their final performance by 10% compared to those who only took the test with no feedback. The interesting finding was that delayed feedback yielded even better final performance, which has been replicated in other studies (Butler & Roediger, 2007; Smith & Kimball, 2010). Larsen (2018) explained that retrieval practice with feedback provides a path in which learners can more accurately assess their learning and modify their approach to the information as needed. Providing opportunities for engagement with peers in addition to the feedback allows learners to consider alternative ideas and more deeply embed the new information for easier retrieval later.

Engagement with Peers (Collaboration)

Moreira et al. (2019) revealed through their research that collaboration improves learning following retrieval practice. Collaboration following assessments promotes active learning, increasing conceptual understanding, information retention, and problem-solving and critical thinking skills (Gilley & Clarkston, 2014). When students engage in conversations and provide feedback to their peers, they develop their judgment and increase their understanding (Tai et al., 2018). Another benefit of collaboration is reducing anxiety and increasing confidence and motivation, as Pandey and Kaptianoff (2011) reported. Research conducted by Tullis and Goldstone (2020) supported the premise that long-term retention of information was stronger when peers actively discussed and challenged one another. They further argued that peer interactions improved the students' ability to solve novel problems, which will help with testing and work as a school leader.

In summary, practice testing improves retention and memory, especially for high-stakes exams like Praxis, and when combined with feedback, it helps students regulate their learning and make corrections. Immediate and delayed feedback has benefits, with delayed feedback showing even better performance. Collaboration following assessments enhances learning by promoting active engagement, conceptual understanding, and problem-solving skills while

reducing anxiety and increasing confidence and motivation. When learning is enhanced, the candidates are much more prepared to lead in a time of change.

Methods

This study aimed to investigate the use of online practice tests to help principal candidates prepare for the Praxis exam and explore their perceptions of the process. The mixed methods research design was conducted as it offers a more in-depth understanding of smaller cases and methodological flexibility (Maxwell, 2016). Creswell and Plano Clark (2018) point out that this type of design also has breadth and depth.

Participants

A small grant of $1,000 was awarded to cover the practice test costs, so the sample was limited to 30 principal candidates who were at the end of their program in the Alabama PPP. All students in their last course in the instructional leadership program were invited to participate in the study. Thirty were randomly selected and divided into three cohorts: Cohort 1 took the practice tests five times; Cohort 2 took the practice tests five times as well and had opportunities to meet colleagues for collaboration following the five testing experiences; Cohort 3 was randomly selected from all other candidates who agreed to participate in the study. This cohort did not do practice testing, but their final Praxis outcomes were compared to the other two cohorts. The demographics of all three cohorts were consistent, with participants having over five years of teaching experience, 75% having 10^+ years of experience, and 75% of participants teaching in rural schools. Two participants dropped out of the process for varying reasons leaving 28 as the final number in the study.

Data Collection

An online practice testing service was selected as it was formatted to resemble the Praxis exam regarding the number of questions and imposed time limits. It also provided detailed, immediate feedback. The various testing modes included no time limit, timed, and immediate or delayed feedback. A timeline was established to complete each of the five practice exams for both cohorts. A synchronous meeting was held following each practice exam for Cohort 2 to allow participants to engage with their peers to share their learning, ask questions and receive further feedback from their peers and instructors.

Quantitative data were collected for Cohorts 1 and 2 following each of the five practice exams, and final scores from the Praxis (5412) exam were collected for Cohorts 1 and 2 and the random group. Qualitative data was gathered from a short survey about perceptions of the practice exams and the process. Data were entered into the Intellectus Statistics software program for analysis.

Results

Research Question 1: Is there a difference in practice test scores for students who participate in Praxis practice exams and those who participate in Praxis practice with collaboration groups? A two-tailed independent samples *t*-test was conducted to examine whether the mean of the scores was significantly different between Cohort 1 (tests only) and

Cohort 2 (tests with collaboration). The Welch's t-test was not significant based on an alpha value of .05, $t(78.64) = 1.63$, p = .106, and are presented in Table 1.

Table 1

Two-Tailed Independent Samples t-Test for Score by Cohort

Variable	Cohort 1		Cohort 2		t	p	D
	M	SD	M	SD			
Score	151.40	17.12	146.80	9.62	1.63	.106	0.33

Note. N = 95. Degrees of Freedom for the *t*-statistic = 78.64. *d* represents Cohen's *d*.

Research Question 2: Is there a difference in final Praxis passing scores for students who participate in Praxis testing and those who do not? The observations for the three groups are seen in Table 2. Cohort 1 (Test-Only) had an average mean of 164.30 (SD = 9.26); Cohort 2 (Collaboration) had an average mean of 162.12 (SD = 9.28); and Cohort 3 (Random) had an average mean of 155.70 (SD = 10.08).

Table 2

Summary Statistics Table for Interval and Ratio Variables

Variable	M	SD	N	SE_M	Min	Max	Skewness	Kurtosis
Test Only	164.30	9.26	10	2.93	150.00	179.00	0.006	-1.11
Collaboration	162.12	9.28	8	3.28	150.00	172.00	-0.35	-1.64
Random	155.70	10.08	10	3.19	137.00	169.00	-0.56	-0.80

An ANOVA was examined based on an alpha value of .05 to see if there was a difference between the mean scores of the groups, and the results were not significant, $F(2,25) = 2.16$, p = .136 which indicates the groups were all similar as seen in Table 3.

Table 3

Analysis of Variance Table for Score by Cohort

Term	SS	df	F	p	η_p^2
Group	395.60	2	2.16	.136	0.15
Residuals	2,289.07	25			

An ANOVA was also examined based on an alpha value of .05 to see if there were significant differences between cohorts in passing the Praxis the first time. The results were significant, $F(1, 26) = 5.25$, p = .030, which indicates significant differences between those who

had the experience of practice testing and the random group, shown in Table 4. There were no significant effects in the model. As a result, post hoc comparisons were not conducted.

Table 4

Analysis of Variance Table for Cohorts by Passed the First Time

Term	SS	Df	F	P	η_p^2
Passed the First Time	3.36	1	5.25	.030	0.17
Residuals	16.64	26			

Research Question 3: What are principal candidates' perceptions of practice tests, feedback, and peer engagement in preparation for the Praxis exam? This was addressed through open-ended questions participants completed following the practice exams. Since the number of responses was small, responses were hand coded and put into categories. The following themes emerged: content/structure, time, confidence building, collaboration, and discussions, as seen in Table 5.

Table 5

Themes from Open-ended Questions

Questions	Categories
What do you believe were the strengths of the practice exams?	Content/Structure (standards, question format, variety); Time (pacing, pressures); Confidence Building; Feedback (immediate, delayed); Discussions (for those in the collaboration cohort)
What do you believe were the challenges of the practice exams?	Structure (time); Content (Theorists/Theories)
If you were in the collaboration group, describe the benefits you feel the meets had for you.	Feedback; Confidence Building; Discussions (common issues); Test-taking strategies
What were your top three takeaways from this experience?	Confidence Building; Time (pacing and time management); Content; Feedback; Collaboration; Test-taking strategies

Content/Structure

Participants felt it was helpful to practice questions using the ASIL in a format that will be used on the exam. The variety of the questions also helped them to think across the standards. Some responses included: "The way the questions were presented was a major help in learning how to choose the best answer and not look for just the right answer." "It showed me the kinds of questions to expect for the actual Praxis. It gave me a great overview of my strengths and weaknesses regarding the test." "The application questions helped to put things I've learned into real-life situations."

Time

Putting participants under the time constraints of the test helped build stamina and time-management skills, as evidenced in these responses: "It helped being timed and learning to pace

myself to finish the test." "It was very time-consuming considering the time to test and then going back and reading the explanations." "The length of the practice test helped to build my test stamina." "Pacing is important."

Confidence Building

Participants reported an increase in confidence and a decrease in anxiety, as seen in some of the following responses: "It made me less nervous about taking the Praxis." "I learned not to fear the two hours." "I learned it's not about choosing the right answer, but the best one. Just breathe your way through it." "It calmed and relaxed me."

Collaboration and Discussions

Engagement with peers was appreciated. Some responded, "It was helpful to hear others shared my anxiety about the test." "I enjoyed being part of a group to discuss each practice test in depth." "I enjoyed being part of a group so I could discuss each practice test in depth." "It was very encouraging." "It helped to hear from fellow educators and get confirmation of my own reflections." "The discussions helped me to realize we're all in this together."

Test-Taking Strategies

During the collaboration, participants increased their test-taking strategies. Some comments were: "I learned some test-taking strategies as well as some areas of weakness that I needed to focus on as I continue to prepare." "It was nice to hear different study strategies." "It was helpful to hear how others were studying for the exam." "Listening to others and how they studied and interpreted the practice exams was very helpful."

Implications and Future Avenues of Research

Participating in retrieval practice through practice testing when preparing for the Praxis (5412) exam impacted the principal candidates in a PPP in helping them pass the exam the first time. In addition, participants reported gaining confidence and reducing anxiety through practice, feedback, and engagement with their peers, like the results of Tai et al. (2018). Principal candidates were also given opportunities to transfer knowledge of the ASIL standards to novel decision-making situations, which helped them build critical thinking skills that Gilley and Clarkson (2014) found in their research. Developing judgment and decision-making skills will benefit the candidates entering the complex world of school leadership, especially during times of change (Darling-Hammond et al., 2022).

Implications for Principal Preparation Programs

Despite the challenges of helping students retain information long-term, research from cognitive science has emerged that can guide educators to use tools and create systems that promote long-term retention of information. One such tool is retrieval practice (Larsen, 2018). Dunlosky et al. (2013) shared that improving educational outcomes requires efforts to help students better regulate their learning through effective learning techniques such as practice testing. When considering that retrieval practice produces greater long-term retention, improved final performance on assessments, and enhanced transfer of knowledge, principal preparation programs should consider providing opportunities to students for practice testing for the Praxis 5412 exam. Testing should be considered a learning tool and an assessment, especially when it requires thoughtful processing (Roediger & Butler, 2011). Embedding practice questions into the

program courses would be one way to engage students in retrieval practice. Another is to provide opportunities to participate in taking specifically designed Praxis practice exams available online to meet the changing needs of the students. Roediger and Butler (2011) shared that the "integration of retrieval practice into educational practices has the potential to boost performance in schools" (p. 25). Research supports the use of online review quizzes as a tool to help students boost factual knowledge and application (Stanger-Hall et al., 2011; Thomas et al., 2018). Finally, increasing opportunities for candidates to engage with their peers should be considered.

Future Avenues for Research

This study was limited in size due to financial restraints. Future research using a larger sample size may yield different results with the testing data. Another future research endeavor would be to explore how embedding practice questions within the courses of the PPP would impact Praxis exams and students' perceptions. It would also be helpful to explore students' perceptions of collaborating with peers in various group settings to see which may meet their needs best.

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