The Impact of Test Anxiety on Teacher Credential Candidates

Bahiyyih Hardacre, Anne Hafner, & Phyllip Nakama

Abstract

Teacher candidates in California are required to pass four standardized tests: the California Basic Educational Skills Test, the California Subject Examinations for Teachers, the Teacher Performance Assessment, and the Reading Instruction Competence Assessment. Many underrepresented minority teacher candidates fail to pass these required tests in order to enter and complete the credential program. In this mixed-methods study, we aimed to identify which background variables (e.g., grade point average, gender, first-generation college), language characteristics (English first language), psychological factors, or physiological indicators, such as heart rate, were correlated with candidates' test-taking anxiety. Findings showed that although respondents reported liking writing and reading, they reported not liking math. Three-quarters of the respondents reported some to a lot of anxiety about taking these standardized tests. Respondents did not score highly on the general depression, anxiety, and stress scales. Respondents performed poorly on multiple choice and constructed response items, especially on math items. When students were asked about reasons for test anxiety, the themes that emerged were test anxiety, math anxiety, writing anxiety, test preparation, and testing as a barrier to future employment. A multiple regression showed that test anxiety and attitude

Bahiyyih Hardacre is an associate professor, Anne Hafner is a professor, and Phyllip Nakama is a graduate of the Ed.D. program, all in the Department of Applied and Advanced Studies of the Charter College of Education at California State University, Los Angeles. Email addresses: bhardacre@calstatela.edu, ahafner@calstatela.edu, & pnakama@calstatela.edu

toward math were the main predictors of general anxiety. Physiological measures of stress (including electrodermal activity and heart rate variability) were significantly related to demographic factors, such as being born outside the United States and the number of years that second language learners had been living in the United States. Test anxiety was significantly correlated with participants' scores on the depression, anxiety, and stress scales and with students' scores on the multiple choice math test and on stress experienced during a multiple choice math test and on a writing task. Identification of which factors predict test anxiety for credential candidates can help college staff and faculty members better understand the roots of the problem of low pass rates on teacher tests.

Introduction

Arne Duncan (2009), U.S. Secretary of Education, said, "I'm very concerned that increasingly, our teachers don't reflect the great diversity of our nation's young people." High-quality education begins each day with teachers in classrooms across the country, and the quality of a student's teacher is the single most influential in-school factor in academic achievement and future life outcomes (Milem, 2003), along with a teaching workforce that reflects this increasingly diverse nation.

All teacher candidates in California are required to pass several standardized tests. Teacher candidates must pass the California Basic Educational Skills Test (CBEST; assessing reading, writing, and math) and the California Subject Examinations for Teachers (CSET) before entering a credential program and the Teacher Performance Assessment (edTPA) at the end of the multiple-subject credential program. Elementary teachers (i.e., K–8, multiple subject) and educational specialists (e.g., special education teachers) are also required to take and pass the Reading Instruction Competence Assessment (RICA), which includes a multiple choice and case study exam as well as a video performance by the candidate. All multiple- and single-subject teacher candidates must take and pass the other three tests as these examinations are required by the California Commission on Teacher Credentialing (CTC). In part because of these tests, stress and anxiety are common among teacher education candidates (Cassady, 2010; Zajacova et al., 2005).

From 2012 to 2017, the overall pass rate for all CSET exams was 80%. The overall CSET math pass rate was 65%, the CSET chemistry pass rate was 80%, and the CSET physics pass rate was 64%. Darling-Hammond, Sutcher, and Carver-Thomas (2018) stated that the CSET "stands as a significant barrier to enroll in many teacher education programs, especially in high need fields such as math and science" (p. 26). About two-thirds of candidates pass the edTPA on the first attempt, and about 40% of those students who intend to go into teaching are not able to because they cannot pass one or more of these tests (Darling-Hammond et al., 2018).

There is some evidence that undergraduates have shown declining interest in teaching over the past 15 years. Faculty members in colleges of education complain about shortages of "qualified" applicants. Darling-Hammond et al. (2018) believe

that the CTC testing requirements may account for much of the decline in enroll-ments. CTC recently reauthorized subject matter programs of study for elementary multiple-subject teachers (as a substitute for taking the CSET), but it remains to be seen if this will help additional students enter teaching.

Recent publications have discussed the usefulness of such accountability mandates in teacher education. One dominant accountability paradigm in teacher education identified by Cochran Smith et al. (2018) is the use of test scores as the primary measure of students' learning. Another accountability initiative, which is intended to improve the quality of teaching, comprises standardized tests like the Performance Assessment for California Teachers (PACT) or edTPA. Used in more than 40 states, the edTPA has become one of the most prevalent forms of high-stakes evaluation for student teachers, with several states requiring candidates to pass the edTPA to gain teacher certification (Potter, 2020). State mandates have resulted in the edTPA being a nationally available and widely used assessment. Nevertheless, other publications have examined the consequential validity of us-ing the edTPA in an urban teacher preparation program and argued that there is not strong consequential validity evidence to support the use of the edTPA as an assessment during student teaching (Behizadeh & Neely, 2018; Potter, 2020).

A major problem is that many underrepresented minority teacher candidates fail to pass these tests, which are required to enter a credential program. Others pass the two initial tests (CBEST and CSET) and then fail the other two tests (edTPA and RICA), which are supposed to be taken while enrolled in the credential pro-gram. A recent article that studied the validity of the edTPA in Washington State found that Hispanic candidates were three times more likely to fail the edTPA compared with non-Hispanic White candidates (Goldhaber, Cowan, & Theobald, 2017). Moreover, underrepresented minority students have shown low pass rates on these tests compared with Asian and White students (Goldhaber et al., 2017). Thus there is a disproportionate impact of these tests on these underrepresented credential students who wish to become teachers.

Reasons for the disproportionate impact on underrepresented minorities have been suggested. Some educators have theorized that the CBEST, the CSET, and the edTPA all focus on candidates' writing capacities, which may disadvantage under-represented minorities and students whose first language is not English (Cowan & Goldhaber, 2016). This fact may lead to students' anxiety, but it is unclear what the largest factors that relate to these students' test anxiety are. Some educators theo-rize that many first-generation and underrepresented students have anxiety about tests in general (Dawood, et al., 2016). Access to higher education for Hispanics in the United States has been a struggle, and barriers to higher education, such as standardized tests, impede access, persistence, and graduation for Hispanics due to many factors, including, but not limited to, structural racism and discrimina-tion (Feagin & Cobas, 2013). Some studies have shown that as a result of hostile campus racial climates and racial microaggressions, students of color and, more

specifically, Hispanic students question their academic self-concept, retention to an institution, graduation prospects, and sense of belonging (Hurtado & Carter, 1997; Yosso, et al., 2009). Racial battle fatigue scholarship has been used to describe the experiences of students of color in postsecondary settings, investigating how racial microaggressions impact the psychological, physiological, and behavioral stress responses of people of color (Franklin, Smith, & Hung, 2014). Previous research investigating psychological distress in college settings for Hispanic students witnessed that students felt alienated and isolated and experienced greater racialized stress than their White peers (Villalpando, 2003; Yosso et al., 2009). Some studies have demonstrated that Hispanics experience a debilitating amount of anxiety in college (Franklin et al., 2014; Otero, Rivas, & Rivera, 2007; Yosso et al., 2009).

Because many underrepresented students continue not to pass required tests to enter credential programs, the purpose of this study is to examine the anxiety that teacher candidates in California have about taking required teacher tests and to study the background, psychological, and physiological variables that correlate with this anxiety. The largest implication for minority candidates is being blocked from the teaching profession by failing to pass the tests.

In this study, researchers gave several surveys (including demographic and psychological items) to credential candidates, administered a writing sample and test items, and took physiological measurements of the students to gauge their level of anxiety while completing test items. Predictive factors include demographics, such as first-generation students, English as a first language, ethnicity, anxiety about tests, beliefs about subject matter, high school grade point average (GPA), college GPA, and psychological aspects like depression, anxiety, and stress. The research questions guiding this study were as follows:

1. Which background characteristics, language characteristics, psychological factors, and physiological indicators are correlated with candidates' test anxiety?

2. Which tests are teacher candidates most anxious about, and why?

3. How do minority candidates perceive the licensure exams as barriers to becoming a teacher?

4. What programs and strategies are needed by teacher candidates to prepare for the teacher tests?

This study was conducted in a medium-sized federally designated Title III/V and Hispanic-serving institution in the western United States. In addition, it is a master's institution. A large proportion of its undergraduate and graduate students are Latinx, and many are English learners. On this campus, teacher candidates have shown lower passage rates on teacher tests compared to teacher candidates in other state colleges.

Identification of which factors predict test anxiety for credential candidates can help colleges, staff, and faculty members better understand the roots of the

problem of low pass rates on teacher tests. In addition, the study may lead to practical strategies for assisting teacher candidates to successfully attempt and pass the required exams. For example, the college could provide training in anxiety regulation, mathematics skills, or time management skills. The project informs the teacher preparation profession and faculty in teacher education about the factors that inhibit or enable teacher candidates to pass the required tests.

The rest of this article proceeds as follows. In the "Literature Review" section, the accountability movement as well as the construct and predictive validity of these tests are explored. Next, the status of California teacher qualification requirements is detailed. Following that, the literature on test anxiety and psychophysiological correlates of anxiety is presented. We discuss our data and methods in the "Methods" section. Our findings are presented in the "Findings" section. The article ends with policy implications and conclusions.

Literature Review

This literature review examines the role of standardized tests in the pursuit of increased accountability in teacher preparation programs. This is followed by a discussion on the construct and predictive validity of teacher tests. The later segments of this review provide a brief overview of relevant literature on anxiety and stress and a description of psychophysiological correlates.

Accountability in Teacher Education

In the past 20 years, the U.S. higher education system has seen increasing accountability, improving what was described by many critics as a broken system (Duncan, 2009). Because U.S. children have consistently scored much lower than children in other countries on several international achievement tests, teacher quality and neoliberal economic trends that define teacher quality by large gains in student achievement gained in prominence, especially in the U.S. Department of Education and accreditation agencies (Cochran Smith et al., 2018).

The No Child Left Behind Act mandated that all teachers be "highly qualified." Along with standards that became prolific in education, accreditors increasingly created new program accreditation standards that shifted from teacher inputs to teacher outcomes. The National Council for the Accreditation of Teachers (NCATE) was the primary national accrediting organization from 1990 to 2013, when a merger occurred and the Council for the Accreditation of Educator Professionals (CAEP) was born. NCATE and CAEP aimed to elevate the status of teachers on a national basis. Although many of the states already had state-level accreditation agencies, NCATE (and CAEP) became the gold standard for colleges of education that strived for a top-notch reputation.

Teacher accreditation standards shifted in recent years to focus on teacher

outcomes. The use of teacher testing has greatly expanded. The tests purport to measure teachers' skills and knowledge about teaching. But some critics have conducted research that has found that the tests measure academic ability and writing ability rather than teacher knowledge, skills, and pedagogy.

Construct and Predictive Validity of Teacher Tests

Teacher certification or licensure is a process of screening individuals to guarantee a minimum level of teacher quality. Licensure is conducted largely by the states. The American Association of Colleges for Teacher Education reports that currently, there are 837 educator preparation programs in 41 states and the District of Columbia participating in the edTPA.[1] Other tests are also used, including the Cal TPA, PACT, and others. Although they are widely used, much uncertainty exists about the tests' value as screening and predictive tools.

Henry et al. (2013) examined teacher preparation programs' indicators of progress and performance to ascertain which indicators might account for variation in credential candidates' effectiveness in the classroom, as measured by value-added student outcomes. The study found that rating instruments, disposition surveys, clinical practice observation ratings, and portfolio assessments all measured a single dimension. Neither these instruments nor candidates' scores on the PRAXIS teacher test predicted their later effectiveness as teachers. The only variable that significantly predicted their later teaching effectiveness was their college GPA.

Other large differences have been found between the scores of White candidates and those of underrepresented minorities (Goldhaber et al., 2017). In New York, it was revealed that Black and Hispanic teacher candidates were more likely to fail the edTPA and a basic skills test (Academic Literacy Skills Test) compared to candidates from other ethnic groups (Taylor et al., 2017). For the ALST, 64% of White candidates passed the test, whereas only 46% of Hispanic and 41% of Black candidates passed it. In response to some of these findings, the New York State Board of Regents lowered the passing score for the edTPA, delayed its consequential status, and created a multiple-measures approach into its certification process to allow those who failed to become certified based on teacher recommendations (Taylor et al., 2017).

The relationship between teacher testing and teacher effectiveness, using value-added estimates of student achievement, has been examined. Goldhaber (2007) found a positive relationship between the two variables, but the estimates were very small. Goldhaber analyzed administrative records for North Carolina between teacher performance on licensure exams (PRAXIS) and student reading and math test scores. He found that teachers who met the North Carolina standards were more effective in math than teachers who did not meet the standards, by 6% of a standard deviation. Goldhaber concluded that licensure test performance "is not a silver bullet that can be used to predict teacher effectiveness" (p. 791).

The accurate prediction of teacher candidates' high and poor performance

on the PACT by supervisors and academic factors was investigated by Sandholtz and Shea (2015). They examined whether academic factors predicted high or low performance and to what extent university supervisors accurately predicted candidates' low and high performance on the test. Researchers found a lack of agreement between predicted success and actual candidate scores on the PACT. They concluded that the academic requirements of the test might be more important than teacher skills because students need to be skilled in writing to perform well on the PACT. Researchers stated that it may not be wise to rely on a single score to measure teacher candidates because of the test's lack of predictive validity.

The predictive validity of teacher candidate performance of the edTPA was investigated by Goldhaber et al. (2017), who used longitudinal data from Washington State to evaluate whether edTPA scores predicted the likelihood of entering teaching as well as value-added student measures of teacher effectiveness in math and reading. EdTPA scores were found to be highly predictive of a teacher candidate being employed as a teacher. When looking at the edTPA as a pass/fail event, these researchers found that passing the edTPA significantly predicted teacher effectiveness in reading but not in math (0.252 standard deviation higher than students whose teachers failed the test). No significant relationship was found for math performance. Researchers also found that Hispanic teacher candidates scored significantly lower than non-Hispanic White candidates on the test. Hispanics were three times more likely to fail the edTPA than non-Hispanic White candidates when it had consequences (13.7% for Hispanics vs. 3.7% for non-Hispanic Whites).

Generalized Anxiety, Academic Anxiety, and Test Anxiety

In the psychology literature, anxiety is typically characterized by feelings of tension, worried thoughts, and negative physiological reactions (Sarchiapone et al., 2018). Heightened levels of anxiety are often manifested when individuals encounter environments and scenarios that invoke feelings of fear or worry, such as a situation where an individual's abilities are being assessed. When faced with an assessment of ability, it is common for an individual to be concerned about negative consequences resulting from that assessment. Assessment of one's ability with potential negative consequences is common in a college setting. The American College Health Association (ACHA) conducts regular assessments of national college student health, and in fall 2017, the ACHA administered a survey to 26,139 students nationwide. The survey asked students about general health, academics, nutrition, and mental health, among other variables. As part of the mental health items, students were asked how often they felt overwhelming anxiety, and 61% of all students reported feeling anxious at any time in the last 12 months (American College Health Association, 2017). This high rate of anxiety can contribute to poor academic performance in students, and this kind of anxiety that occurs in educational settings is referred to in the literature as *academic anxiety* (Cassady, 2010).

One form of academic anxiety is test anxiety, which may lead to low confidence or to poor performance on exams (Putwain & Symons, 2018).

Test anxiety is differentiated from other forms of anxiety through its focus on evaluative (i.e., testing) situations. Recent estimates have suggested that between 15% and 22% of students exhibit high levels of test anxiety (Thomas, Cassady, & Finch, 2018), which can be detrimental to their performance on the assessment given that much research has demonstrated a relationship between test anxiety and poor test performance (von der Embse & Witmer, 2014).

Teacher credential candidates face stress in their academic programs. However, students of color in credential programs face extreme stress resulting from subtle or overt discrimination that may create a type of "racial battle fatigue." According to Smith (2008) and Pierce (1995), commonly, campus race relations for students of color cause extreme environmental stress, which leads to psychological and physical stress.

Anxiety is often described as involving the emotion of fear or worry of negative evaluation that results in a negative behavioral, physiological, or emotional response (von der Embse, et al., 2018). Test anxiety is one of several triggers of anxiety. Stress, on the other hand, is often described as "the emotional tension associated with a sustained state of anxiety in response to the threat of a negative event" (Mandrick, et al., 2016, p. 62). The maintenance of an optimal cognitive performance is a constant challenge, and to ensure that the body is alert and ready to respond to a challenge, it is kept at a constant state of stress. This is particularly true in environments where individuals have to cope with a high mental workload (Borghini, et al., 2014) and stressful situations (Causse, Peysakhovich, & Fabre, 2016). Contexts of high mental workload and stress (e.g., high-stakes standardized tests) may result in transient impairments of working memory (Starcke, et al., 2016), which will in turn affect test performance.

Both anxiety and stress can be assessed by measuring a person's physiological functions of the autonomic system. The most basic indicators of the state of a person's autonomic nervous system are heart rate variability (HRV) and electrodermal activity (EDA). The former is influenced by the sympathetic and parasympathetic systems, whereas the latter is under sympathetic control only.

HRV refers to the variations of heart rate interbeat intervals over time. HRV has been used in physiological research as a biomarker of autonomic health. Autonomic health refers to a person's ability to recover quickly from emotional states. There is converging evidence suggesting reduced HRV plays a critical role in the development of anxiety disorders and can be considered as an important endophenotype of anxiety (Friedman, 2007).

EDA measures changes in the electrical conductance of the skin, which depends on the quantity of sweat secreted by eccrine sweat glands in the hypodermis of the palmar and plantar regions. Sympathetic nervous activity and variations in the sweating of the skin are regulated by environmental temperature (thermoregu-

latory sweating) and by central nervous activity related to affective and cognitive states (palmar, mental, or emotional sweating; Sarchiapone et al., 2018). EDA has been used as an index of emotional stimulation in several experimental studies (Sarchiapone et al., 2018). Electrodermal hyporeactivity (increased latency and lower amplitude) has been shown to correlate with anxiety (Thorell et al., 2013).

Stress and anxiety are responses to environmental challenges, allowing the body to be prepared to face a difficult situation with focus, strength, and heightened alertness. Stress and anxiety are regulated by the sympathetic branch of the autonomic system, and because of that, changes in stress levels can be measured by recording electrodermal activity (EDA). EDA has been extensively proved to be a very practical and noninvasive method to measure levels of stress in a person. For example, Jacobs et al. (1994) examined the cardiovascular changes caused by psychological stress during mental stress testing conditions, and they showed that EDA levels were a stable and useful index of stress. Another study conducted by Liu and Du (2018) suggested that using EDA as a method for detecting psychological stress levels was a more practical alternative for detecting stress in study participants, as it is noninvasive. Another example provided by Villarejo, Zapirain, and Zorrilla (2012) recorded both EDA and HRV combined in a device they created to detect early signs of stress in their study participants, adding their results to a vast collection of literature that validates the use of these two biomarkers in research on stress and anxiety.

Methods

This section describes the methods that were used to conduct the study. This includes the study design, sample, instruments, data collection procedures, and data analysis procedures.

Design of the Study

The study was a descriptive and correlational study conducted at a college campus. Students filled out a survey, completed test questions from CBEST and CSET, and were measured on psychological and physiological traits.

Data Collection Procedures

The researchers made flyers to advertise the study, and these included an email contact. Recruitment was carried out through the placement of flyers in bathrooms and on noticeboards across campus. One faculty member also attended classes to recruit either undergraduate students in blended programs or credential students.

The procedure took about 45 minutes to 1 hour. Students received a Starbucks gift card as an incentive to participate. At the appointment, students first took the survey, then the researchers placed the physiological monitors on participants and

checked to make sure they were operational. Students then sat at a desk and were instructed to write down the times when they started each task, while their heart rates and skin conductance were being measured.

Resting baselines were recorded to aid in the interpretation of fluctuations of participants' heart rate and skin conductance during the experiment. These baselines were recorded while participants sat quietly and alone in a room, in a relaxed position, for 5 minutes. Participants were told to try to relax and refrain from moving excessively, checking their phones, crossing their legs, or falling asleep.

Sample

The sample was a purposive sample that used either undergraduates in blended programs who planned to be teachers, precredential students, or credential students. This pilot study included 75 students.

Instruments

The instruments used in this study comprised a demographics survey, the Depression, Anxiety, and Stress Scale (DASS-21), a sample selection of CBEST and CSET test items, and ongoing monitoring and recording of physiological data.

Demographic survey. Upon participants' arrival, they were asked to sign a consent form. After that, they were asked to take a survey that included questions inquiring about their background variables, such as gender; ethnicity; English as a first/second language; first-generation college student; born in the United States or not; high school GPA; college GPA; program enrolled in; contribution of the program to student preparation to take exams; and attitudes toward writing, reading, and math. Also included were questions about which teacher tests students had taken and their anxiety about taking different tests. Questions about what types of preparation students use before taking the test were included, as well as which type of programs students would like to help them prepare for exams. Several constructed response items were given to students. These included the following: (1) List a few reasons why students may have anxiety about taking the CBEST and CSET; (2) To what extent do you believe that test anxiety has affected or might affect your performance on the CBEST or CSET?; and (3) What strategies do you think are useful to help relieve students' test anxiety related to taking the CBEST or CSET?

Depression, Anxiety, and Stress Scale (DASS-21). Three short scales were included in the survey. Self-report questionnaires completed by all participants included the Depression, Anxiety, and Stress Scale–21 (DASS-21, 21 items, 3 subscales). The DASS-21 measures the tripartite negative emotional states of depression, anxiety, and stress experienced in the last week, with high internal consistency and reliability (Antony, et al., 1998). Responses were on a 4-point scale ranging from 1 (*Not at all*) to 4 (*Most of the time*). The Depression subscale consisted of seven

items, such as "no positive feeling" and "life is meaningless." The Anxiety subscale consisted of seven items, such as "worried" and "close to panic." The Stress subscale consisted of seven items, such as "getting agitated" and "touchy." This measure has been validated by Osman et al. (2012).

Sample test items. Students were also given sample test items drawn from CBEST and CSET study guides. A total of 13 multiple choice items were included. They included three items about teaching, four items about writing, three items about history, and three math items (primarily fractions and algebra). The first 10 items were drawn from the CBEST, and the math items and writing prompt were drawn from the CSET. One short-answer constructed response item was included. It asked the student, What are two influences on language acquisition in early childhood?

Physiological measures: Heart rate and electrodermal activity. Minimally invasive physiology data measuring instruments were used. The Polar RS-800-CX heart monitor was chosen for heart rate recording because it provides reliable and high-quality data, sampling the heart rate at 1-ms intervals. The Polar RS-800 has been widely used in physiological research, and it is reliable and accurate. To record participants' electrodermal activity, the Empatica E4 wristband was used. The Empatica E4 sensor has the capability to record not only EDA but also heart rate data, serving as a backup recording device for the latter. Both the Polar RS-800 and the Empatica E4 devices export data as comma separated value (csv) files.

Data Analysis Procedures

Quantitative data were analyzed using descriptive statistics, in addition to correlational techniques. Qualitative constructed response items were coded using open coding to identify themes.

Heart rate data processing. Raw heart rate data were extracted as a text file using the native software Polar ProTrainer (Version 5) and imported into free postprocessing software called Kubios (Version 2.0). All data files were initially processed with an automatic filter to remove potential artifacts. Artifact removal was confirmed via visual inspection after export. Kubios was then used to calculate time-domain HRV measures. The two time-domain measures calculated included the standard deviation of all heart rate (R-R) intervals (i.e., SDNN) and the square root of the mean-squared differences between successive R-R intervals (i.e., RMSSD). Higher values of these HRV measures indicate lower stress. Participants' RMSSD resting baseline and activity files were saved separately for the purpose of calculating resting HRV. The resting baseline values were compared to participants' average HRV measures during each task of this experiment.

Electrodermal activity data processing. EDA data were transferred to the lab computer through the Empatica native software E4 Manager (Version 2.0.1). After

the transfer, each participant's data were exported and saved as a csv file. All data files were initially processed with an automatic filter to remove potential artifacts. Artifact removal was confirmed via visual inspection after export. Participants' resting baselines were saved in a separate file for the purpose of calculating resting EDA. These values were to be compared to the average EDA responses for each task of this experiment.

Findings

In this section, descriptive statistics from the survey and test items are presented.

Demographics

Eighty-four percent of the respondents were female. Seventy percent of the sample were Latinx, 21% were Asian, and 5% were White. About half (52%) did not have English as a first language, and 47% did have English as a first language. Twenty-seven percent of the sample was born outside of the United States. Sixty-nine percent were first-generation college students, and 31% were not. The average self-reported high school GPA was 3.25, and the average self-reported college GPA was 3.5.

Attitudes About Their Program

In the sample, 43% of students reported that they were not in a credential program, and 57% reported that they were in a credential program. Not all students reported on which program they were in. Twenty-two percent of students reported being in the multiple-subject credential program, and 13% reported being in the educational specialist program. Only 6% reported that they were in a single-subject credential program. Twenty-six percent of participants reported being in an MA program. When asked about the contribution of their credential program or undergraduate program to their preparation to take the CBEST or CSET test, 78% reported that their program did not prepare them very much for the test, while 22% reported that their program did prepare them well for the test.

Attitudes About Writing, Reading and Math

Students were asked about their attitudes toward writing, reading, and math subjects on tests. Table 1 shows that a majority of students enjoyed writing (53%), and two-thirds of them enjoyed reading (69%). Fifty percent of students reported that they did not enjoy math or were anxious about it, while only 19% of the students reported that they did not enjoy writing tests, and 17% reported that they did not enjoy reading tests.

Experiences With Standardized Tests

Students were asked if standardized tests generally gave them anxiety. The results showed that 27% reported no, 41% reported some anxiety, and 32% reported a lot of anxiety about taking tests. Students were asked if they had taken the CBEST; 26% reported that they had taken it and had passed, and 34% reported that they had taken it and did not pass. Thirty-two percent reported that they had not taken the CBEST but would take it, and 8% reported that they had not taken it and would not take it. Regarding the CSET, 11% reported that they had taken it and passed, 18% reported that they had taken it and did not pass, and 47% had not taken it but planned to take it. In addition, 24% of students had not taken the CSET and did not plan to take it.

Preparation for Tests

Regarding preparation for taking the CBEST, 6% reported that they did not prepare for it, and 17% reported they reviewed some sample items or took a practice test. Thirty percent reported reviewing sample questions and doing a practice test, and 4% reported taking a CBEST prep course. Regarding CSET, 3% reported not preparing for it, and 22% reported that they had either reviewed sample items or taken practice tests. Only 4% reported that they took a CSET prep class.

Programs That Are Needed for Students

Students were asked what kinds of programs were most needed to help students pass exams like the CBEST and CSET; 76% reported that they would like writing workshops, 80% reported that they would like practice tests, and 77% reported that they would like math workshops. Fifty-seven percent reported they would like reading workshops, and 64% reported that they would like a test advisement center.

Depression, Anxiety, and Stress Scale

These scales measure a student's levels of general depression, anxiety, and stress. The total possible points on the subscales was 28 (7 items × 4, the highest choice on the scale, or "most of the time"). The mean on the Stress subscale was the highest at 8. The range of answers was 0–21. The mean on the Anxiety sub-

Table 1
Student Attitudes About Writing, Reading, and Mathematics

Subject	I enjoy it (%)	I don't mind it but may have difficulties (%)	I do not enjoy it and get anxious on tests (%)
Writing	53	27	19
Reading	69	14	17
Mathematics	33	18	50

scale was second highest at 6.37. The range of answers was 0–20. The mean on the Depression subscale was the lowest at 5.22. The range of answers was 0–21. Although the Stress subscale had the highest mean, it was not very high at 7.27, which is "a little bit of stress." Anxiety was close to stress, and depression was the lowest. In general, these participants showed very little general stress, anxiety, or depression.

CSET/CBEST Sample Item Test Performance

Seventy-five students completed the sample test items. The times that they started and finished were noted. The first 10 items were reading items drawn from the CBEST. The three math items and the writing prompt were drawn from the CSET. In general, the students performed poorly on the test items. The overall mean percentage correct on the reading multiple choice items was 45%, and the overall percentage correct on the math items was 26%. The writing sample was graded on a 1–3 scale, where 3 was considered adequate to good, 2 was considered satisfactory, and 1 was considered unsatisfactory. The average on the writing sample was 1.51, which is low and in between unsatisfactory and satisfactory.

Correlations and t-Tests

Major variables were correlated with test anxiety level and anxiety scale score. Because of the small sample size, only a few correlations were significant. High test anxiety was significantly negatively correlated with MATHATT, or attitudes about math. High test anxiety was related to students feeling anxious when taking math tests, $r = -.30$, $p < .05$. In addition, high test anxiety was significantly correlated with high general anxiety, $r = .35$, $p < .01$. READATT and WRITATT (attitudes about reading and writing) were significantly correlated, $r = .41$, $p < .00$). If students had positive views on reading, they tended to have positive views about writing. MATHATT was significantly negatively correlated with both WRITATT, $r = -27$, $p < .05$, and with READATT, $r = -34$, $p < .01$. The more students liked math, the less they liked reading and writing. In addition, students who were born outside of the United States showed a favorable attitude toward math tests, $r = .33$, $p < .01$. The anxiety scale score was significantly correlated with the stress scale (.69), $p < .00$.

Background variables were correlated with a measure of anxiety (EDABASE), which is similar to skin conductance, or the galvanic skin response (GSR). If a student was born outside of the United States, the student was likely to show higher stress, $r = .23$, $p < .05$. The same pattern was found with a measure of stress measured while students were taking the writing test. If a student was born outside the United States, the student showed high stress on the writing task, $r = .29$, $p < .05$.

A physiological measure of stress (electrodermal activity, or EDA) was significantly related to being born outside of the United States. Participants' HRV, which is considered a biomarker of emotional regulation, showed a positive high

correlation with the number of years that second language learners had been living in the United States.

Test anxiety was positively correlated with participants' scores on depression, anxiety, and stress scales. Test anxiety was also correlated and with participants' scores on the multiple choice task (Task 2, math questions) and with their EDA (stress) during tasks 2 and 3 (math questions and writing).

Having prepared for the CBEST was negatively correlated with their stress scale, with RMSSDBASE and with RMSSD Task 1. Having prepared for the CSET was negatively correlated with participants' scores on the stress scale, meaning that participants who reported having prepared for the exam also scored lower on the stress scale.

Tests were conducted on the following dependent variables: depression scale score, anxiety scale score, stress scale score and test anxiety. Independent variables included first-generation student or not, English as first language or not, and born in the United States or outside the United States. Most of the *t*-tests were not significant. However, students who reported being born outside the United States showed significantly lower levels of general depression compared to those born in the United States, $t(49) = 2.43$, $p < .05$. Reasons for this are unclear.

Multiple Regression Findings

A multiple regression was run using the general anxiety scale score as the dependent variable. Independent variables included test anxiety, English as first language, born outside the United States, and MATHATT. In the regression results, the adjusted R^2 was .21, $F(4, 46) = 3.14$, $p < .05$. Test anxiety was the highest and only significant predictor of general anxiety, $\beta = .39$, $p < .01$, followed by MATHATT, $\beta = -.21$, $p < .05$. High test anxiety and feeling anxious about taking math tests predicted general anxiety.

Constructed Response Items

Three constructed response items were included in the survey:

1. What are reasons why students may have anxiety about taking these tests?

2. To what extent do you believe that test anxiety has affected or might affect your performance on the CBEST or CSET?

3. What strategies are useful to help to relieve anxiety about taking tests?

Students' responses to the constructed response items were analyzed using a priori coding with themes. The five themes were test anxiety, writing anxiety, math anxiety, test preparation, and testing as a barrier. Table 2 contains the themes, a brief description of each one, and example quotations. The themes are then described in detail.

Theme 1: Contributors to test anxiety. Anxiety is a phenomenon that causes students to perform poorly in their academics or on tests (Dawood et al., 2016). Although anxiety can negatively impact students' academic performance, a moderate amount of anxiety is necessary to challenge students to work toward their academic achievements (Dawood et al., 2016). Many participants suggested that anxiety led them to be more forgetful and nervous and to perform poorly on tests. One student suggested that "if there is an anxious situation during an exam, I have a hard time concentrating on the exam and also I lose my way to think." Another participant suggested that the environment of where the test was being held contributes to test anxiety as well. For the participants in this study, test anxiety was a factor that negatively affected their ability to successfully complete and pass their teaching licensure exams.

Table 2
Themes From Constructed Response Items

Theme	Brief description	Example quotations
Test anxiety	A phenomenon that creates nervousness, worry, discomfort, and uncertainty for individuals due to test taking.	• I think anxiety has had an extensive effect on me with regard to how I performed on the CBEST. • Test anxiety affected my performance significantly.
Writing anxiety	Anxiety created from writing activities.	• In the writing section, I was worried about not having enough time for other sections.
Math anxiety	An emotional phenomenon that occurs in individuals who fear or are challenged by mathematical problems.	• Just knowing that math would be involved gave me anxiety! • Math questions give me the most anxiety.
Test preparation	Consists of the amount of time dedicated to studying for a future exam; one's participation in test preparation programs increases one's chance of passing a test.	• We need more test preparation workshops or refresher courses. • Need breaks. • Use meditation or affirmations.
Testing as a barrier to entering teaching	When testing is seen as a barrier or "roadblock" that challenges students from reaching their goals for future employment	• I think students might have anxiety taking these tests because it is a requirement to work in the school districts. • Your credential is contingent upon passing these tests.

Theme 2: Contributors to writing anxiety. Writing anxiety primarily affects those who have difficulty writing or fear that their writing is at a nonproficient level. Students who experience writing anxiety become nervous, lose focus, and become less confident taking tests and exams. Students who experience writing anxiety also try to avoid writing activities (Erdogan, 2017). One participant expressed when taking the CBEST and CSET test that "both tests are timed, and students like me who struggle with writing get anxious throughout the whole test because we want to make sure we have enough time at the end for the written responses." Another participant suggested that timed exams make the participant worry about the writing sections of an exam because writing is time consuming. Another student noted that she was not confident in writing, as English was not her first language. These participants' perceptions of their writing experiences during these exams are affected by writing anxiety.

Theme 3: Contributors to math anxiety. Math anxiety can be interpreted as a fear of mathematics that interferes with a person's ability to solve mathematical problems in average daily situations as well as in academic scenarios. Math anxiety can also be influenced by poor socioeconomic background, poor parenting, and poor teacher instruction (Vasquez-Colima, Gonzalez-Dehass, & Furner, 2014). Students who participated in the study showed many concerns that the math section is their biggest obstacle to passing the CSET or CBEST. One participant pointed out that his anxiety for math led him to run out of time due to repeatedly checking answers. One participant stated that the math section on exams frightened her because she does not typically do well on the math tests. Some participants also believed that math anxiety negatively affects their scores on exams because of the stress they encounter during the math sections of teacher licensure exams.

Theme 4: Test preparation. Test preparation can come in a variety of forms, such as time studying for a test, amount of participation in a testing preparation course or program, or knowledge of test-taking strategies. Aware of the importance to prepare properly to pass these exams, students enroll in test prep courses or programs and learn test-taking strategies. However, not all students are well prepared, and therefore they fail these exams. Many participants suggested that studying for an exam, taking practice exams, and studying in groups can increase the probability of passing the CSET and CBEST exams. They also reported that their credential programs and undergraduate programs did not properly prepare them for the CBEST and CSET exams. One participant stated that "students are unprepared and have limited information," which suggests that not all students are well prepared. When participants were asked about how preparation programs can aid in preparing them for tests and relieve them of test anxiety, several students suggested that "more programs, more support from staff, more test preparation workshops, and more or free access to supplies and opportunities" were needed to help students to be successful on their exams. One participant suggested that

"extensive and hands-on training at no cost to students would ease students from stress." It was also suggested that exercise and more sleep can help students be better prepared and relax for tests.

Theme 5: Testing as a barrier to entering teaching. A major contribution to test anxiety is that teacher exams and results are seen as barriers or "roadblocks" for future employment to becoming a teacher. Since both math and writing anxiety are seen as barriers, it is not unreasonable to think that testing is also a barrier. Teacher licensure testing is an obstacle that is essential to becoming a licensed teacher in the state of California. One participant stated, "It is a primary requirement to get a credential." Another participant expressed that "there is a lot of pressure because this test depends on your future." Students who take these high-stakes licensure tests are anxious about their performance when test taking "because they know their scores have a major impact." They also expressed experiencing anxiety due to the possibility that their goals to become a teacher will be delayed by a poor performance on tests. Another participant expressed her concern to pass the licensure tests to become a credentialed teacher: "If you fail, it takes many steps to retake and your future goals will be delayed." Several respondents also reported that these tests are expensive to take: "They are tests of importance and there is a lot riding on it."

Limitations of the Study

This study consisted of only 75 people. It was a small sample comprising mainly women. In addition, it was conducted in only one college.

Summary and Conclusion

Participating students were not generally depressed, anxious, or stressed compared to a national sample of college students. Students in the study performed poorly on the sample CBEST and CSET items. In particular, they scored very low on the math items. Themes that arose from the constructed response items about anxiety and its effect on their test performance included test anxiety, writing anxiety, math anxiety, test preparation, and tests as a barrier to entering teaching.

A multiple regression showed that test anxiety and attitude toward math were the main predictors of general anxiety. A physiological measure of general stress (EDABASE or skin conductance) was significantly related to being born outside of the United States. EDA stress, which was measured while students were completing a sample writing task, was significantly related to being born outside of the United States.

Results of the survey show that students reported being generally anxious about taking teacher tests, in particular math tests. General test anxiety, math test anxiety, and students' beliefs that the tests were barriers to entering the credential program and the teaching field were key findings.

A major theme that arose was testing as a barrier to entering teaching. Candidates perceived testing as an obstacle to becoming a licensed teacher in California. This obstacle can cause racial battle fatigue in underrepresented minority students and can lead to psychological and physical stress for all students. Respondents reported that their teacher education programs did not prepare them well for the exams and suggested providing more programs, more staff support, and test prep workshops.

An understanding of factors leading to racial battle fatigue and test anxiety may help teacher education faculty and program directors implement equitable programs, practices, and policies that help students with health- and stress-related outcomes. Identification of which factors predict test anxiety for credential candidates can help colleges and their staff and faculty members to better understand the roots of the problem of low pass rates on teacher tests. In addition, the study may lead to practical strategies for assisting teacher candidates to successfully attempt and pass the required exams. For example, the teacher education program and faculty could provide training in anxiety regulation, mathematics skills, or time management skills. They could also provide test prep workshops for anxious students. Accrediting bodies could look at how the current testing environment acts as a barrier to entering teaching for many students. This project can inform the teacher preparation profession and faculty in teacher education about the factors that inhibit or enable teacher candidates to pass required tests.

Note

[1] See http://edtpa.aacte.org/

References

American College Health Association. (2017, Fall). *National College Health Assessment II. Reference group: Undergraduate—executive summary*. Hanover, MD: American College Health Association.

Antony, M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and community a sample. *Psychological Assessment, 10*, 176–181. https://doi.org/10.1037/1040-3590.10.2.176

Behizadeh, N., & Neely, A. (2018) Testing injustice: Examining the consequential validity of edTPA. *Equity and Excellence in Education, 51*(4), 242–264. https://doi.org/10.1080/10665684.2019.1568927

Borghini, G., Astolfi, L., Vecchiato, G., Mattia, D., & Babiloni, F. (2014). Measuring neurophysiological signals in aircraft pilots and car drivers for the assessment of mental workload, fatigue and drowsiness. *Neuroscience and Biobehavioral Reviews, 44*, 58–75. https://doi.org/10.1016/j.neubiorev.2012.10.003

Cassady, J. C. (2010). *Anxiety in schools: The causes, consequences, and solutions for academic anxieties.* New York, NY: Peter Lang.

Causse, M., Peysakhovich, V., & Fabre, E. F. (2016). High working memory load impairs

language processing during a simulated piloting task: An ERP and pupillometry study. *Frontiers in Human Neuroscience, 10*. https://doi.org/10.3389/fnhum.2016.00240

Cochran Smith, M., Cummings, M. C., Keefe, E. S., Burton, S., Chang, W., & Fernandez, M. B., (2018). Democratic accountability in teacher education: Now more than ever. *Teacher Education and Practice, 31*(2), 178–206.

Cowan, J., & Goldhaber, D. (2016). National board certification and teacher effectiveness: Evidence from Washington State. *Journal of Research on Educational Effectiveness, 9*(3), 233–258. https://doi.org/10.1080/19345747.2015.1099768

Darling-Hammond, L., Sutcher, L., & Carver-Thomas, D. (2018). *Teacher shortages in California: Status, sources, and potential solutions* (research brief). Palo Alto, CA: Learning Policy Institute.

Dawood, E., Al Ghadeer, H., Mitsu, R., Almutary, N., & Alenezi, B. (2016). Relationship between test anxiety and academic achievement among undergraduate nursing students. *Journal of Education and Practice, 7*(2), 57–65.

Duncan, A. (2009, October 22). *Teacher preparation: Reforming the uncertain profession.* Remarks of Secretary Arne Duncan at Teachers College, Columbia University, New York, NY.

Erdogan, O. (2017). The effect of cooperative writing activities on writing anxieties of prospective primary school teachers. *International Journal of Research in Education and Science, 3*(2), 560–570. https://doi.org/10.21890/ijres.328085

Feagin, J. R., & Cobas, J. A. (2013). *Latinos facing racism: Discrimination, resistance, and endurance*. New York, NY: Paradigm.

Franklin, J. D., Smith, W. A., & Hung, M. (2014). Racial battle fatigue for Latino/a students. *Journal of Hispanic Higher Education, 13*(4), 303–322. https://doi.org/10.1177/1538192714540530

Friedman, B. H. (2007). An autonomic flexibility–neurovisceral integration model of anxiety and cardiac vagal tone. *Biological Psychology, 74*(2), 185–199. https://doi.org/10.1016/j.biopsycho.2005.08.009

Goldhaber, D. (2007). Everyone's doing it, but what does teacher testing tell us about teacher effectiveness? *Journal of Human Resources, 42*(4), 765–794. https://doi.org/10.3368/jhr.XLII.4.765

Goldhaber, D., Cowan, J., & Theobald, R. (2017). Evaluating prospective teachers: Testing the predictive validity of edTPA. *Journal of Teacher Education, 68*(4), 377–393.

Henry, G. T., Campbell, S. I., Thompson, C. L., Patriarca, L. A., Luterbach, K., Lys, D. B., & Covington, V. M. (2013). The predictive validity of measures of teacher candidate progress and performance: Toward an evidence-based approach to teacher preparation. *Journal of Teacher Education, 64*(5), 439–453. https://doi.org/10.1177/0022487113496431

Hurtado, S., & Carter, D. F. (1997). Effects of college transition and perceptions of the campus racial climate on Latino college students' sense of belonging. *Sociology of Education, 70*, 324–345. https://doi.org/10.2307/2673270

Jacobs, S., Friedman, R., Parker, J. D., Tofler, G. H., Jimenez, A. H., Muller, J. E., . . . Stone, P. H. (1994). Use of skin conductance changes during mental stress testing as an index of autonomic arousal in cardiovascular research. *American Heart Journal, 128*(6), 1170–1177. https://doi.org/10.1016/0002–8703(94)90748-X.

Liu, Y., & Du, S. (2018). Psychological stress level detection based on electrodermal activity. *Behavioural Brain Research, 341*, 50–53. https://doi.org/10.1016/j.bbr.2017.12.021

Mandrick, K., Peysakhovich, V., Rémy, F., Lepron, E., & Causse, M. (2016). Neural and psychophysiological correlates of human performance under stress and high mental

workload. *Biological Psychology, 121* (Pt A), 62–73. https://doi.org/10.1016/j.biopsy-cho.2016.10.002

Milem, J. (2003). The educational benefits of diversity: Evidence from multiple sectors. *Compelling Interest,* pp. 126–169.

Osman, A., Wong, J. C., Bagge, C. L., Freedenthal, S., Gutierrez, P. M., & Lozano, E. (2012). The Depression–Anxiety Stress Scale DASS-21. *Journal of Clinical Psychology, 68*(12), 1322–1338. https://doi.org/10.1002/jclp.21908

Otero, R., Rivas, O., & Rivera, R. (2007). Predicting persistence of Hispanic students in their 1st year of college. *Journal of Hispanic Higher Education, 6*, 163–173. https://doi.org/10.1177/1538192706298993

Pierce, C. M. (1995). Stress analogs of racism and sexism: Terrorism, torture, and disaster. In C. Willie, P. Rieker, B. Kramer, & B. Brown (Eds.), *Mental health, racism and sexism* (pp. 277–293). Pittsburgh, PA: University of Pittsburgh Press.

Potter, D. (2020). (In)visible power: A critical policy analysis of edTPA. *Arts Education Policy Review.* https://doi.org/10.1080/10632913.2020.1744053

Putwain, D. W., & Symons, W. (2018). Does increased effort compensate for performance debilitating test anxiety? *School Psychology Quarterly, 33*(3), 482–491. https://doi.org/10.1037/spq0000236.

Sandholtz, J. H., & Shea, M. (2015). Examining the extremes: High and low performance on a teacher performance assessment for licensure. *Teacher Education Quarterly, 4*, 17–41.

Sarchiapone, M., Gramaglia, C., Iosue, M., Carli, V., Mandelli, L., Serretti, A., . . . Zeppegno, P. (2018). The association between electrodermal activity (EDA), depression and suicidal behaviour: A systematic review and narrative synthesis. *BMC Psychiatry, 18*(1), 22. https://doi.org/10.1186/s12888-017-1551-4

Smith, W. A. (2008). Higher education: Racial battle fatigue. In R. T. Schaefer (Ed.), *Encyclopedia of race, ethnicity, and society* (pp. XX–XX). Thousand Oaks, CA: Sage.

Starcke, K., Wiesen, C., Trotzke, P., & Brand, M. (2016). Effects of acute laboratory stress on executive functions. *Frontiers in Psychology, 7*(461). https://doi.org/10.3389/fpsyg.2016.00461

Taylor, B., Francis, B., Archer, L., Hodgen, J., Pepper, D., Tereshchenko, A., & Travers, M. (2017). Factors deterring schools from mixed attainment teaching practice. *Pedagogy, Culture, and Society, 25*(3), 327–345. https://doi.org/10.1080/14681366.2016.1256908

Thomas, C. L., Cassady, J. C., & Finch, W. H. (2018). Identifying severity standards on the cognitive test anxiety scale: Cut score determination using latent class and cluster analysis. *Journal of Psychoeducational Assessment, 36*(5), 492–508. https://doi.org/10.1177/0734282916686004

Thorell, L. H., Wolfersdorf, M., Straub, R., Steyer, J., Hodgkinson, S., & Kaschka, W. P. (2013). Electrodermal hyporeactivity as a trait marker for suicidal propensity in uni- and bipolar depression. *Journal of Psychiatric Research, 47*(12), 1925–1931. https://doi.org/10.1016/j.jpsychires.2013.08.017

Vasquez-Colima, M. D., Gonzalez-Dehass, A. R., & Furner, J. M. (2014). Achievement goals, motivation to learn, and mathematics anxiety among pre-service teachers. *Journal of Research in Education, 24*(1), 38–52.

Villalpando, O. (2003). Self-segregation or self-preservation? A critical race theory and Latina/o critical theory analysis of a study of Chicana/o college students. *International Journal of Qualitative Studies in Education, 16*, 619–646. https://doi.org/10.1080/0951839032000142922

Villarejo, M. V., Zapirain, B. G., & Zorrilla, A. M. (2012). A stress sensor based on galvanic

skin response (GSR) controlled by ZigBee. *Sensors, 12*(5), 6075–6101. https://doi.org/10.3390/s120506075

von der Embse, N., Jester, D., Roy, D., & Post, J. (2018). Test anxiety effects, predictors, and correlates: A 30-year meta-analytic review. *Journal of Affective Disorders, 227*, 483–493. https://doi.org/10.1016/j.jad.2017.11.048

von der Embse, N. P., & Witmer, S. (2014). High-stakes accountability: Student anxiety and large- scale testing. *Journal of Applied School Psychology, 2*, 1–24. https://doi.org/10.1080/15377903.2014.888529

Yosso, T. J., Smith, W. A., Ceja, M., & Solorzano, D. G. (2009). Critical race theory, racial microaggressions, and campus racial climate for Latina/o undergraduates. *Harvard Educational Review, 79*, 659–691. https://doi.org/10.17763/haer.79.4.m6867014157m707l

Zajacova, A., Lynch, S. M., & Espenshade, T. J. (2005). Self-efficacy, stress and academic success in college. *Research in Higher Education, 46*(6), 677–706. https://doi.org/10.1007/s11162-004-4139-z