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Using the Stress and Adversity Inventory as a Teaching Tool Leads to Significant Learning Gains in Two Courses on Stress and Health

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Abstract

The ability to measure cumulative stress exposure is important for research and teaching in stress and health, but until recently, no structured system has existed for assessing exposure to stress over the lifespan. Here, we report the results of two experimental studies that examined the pedagogical efficacy of using an automated system for assessing life stress, called the Stress and Adversity Inventory (STRAIN), for teaching courses on stress and health. In Study 1, a randomized, wait-list controlled experiment was conducted with 20 college students to test whether the STRAIN, coupled with a related lecture and discussion, promoted learning about stress and health. Results showed that this experiential lesson led to significant learning gains. To disentangle the effects of completing the STRAIN from participating in the lecture and discussion, we subsequently conducted Study 2 on 144 students using a 2 (STRAIN versus control activity) by 2 (STRAIN-specific lecture versus general stress lecture) repeated-measures design. Although the STRAIN-specific lecture was sufficient for promoting learning, completing the STRAIN also generated significant learning gains when paired with only the general stress lecture. Together, these studies suggest that the STRAIN is an effective tool for promoting experiential learning and teaching students about stress and health.

Keywords

life events; stress; assessment; experiential activity; transformational teaching; pedagogy; college; mental health; well-being; disease

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Conflict of interest
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Introduction

A large body of research exists showing that stressful experiences occurring over the life course can substantially impact a person's mental and physical health (Dienes, Hammen, Henry, Cohen, & Daley, 2006; Graham, Christian, & Kiecolt-Glaser, 2006; Lupien, McEwen, Gunnar, & Heim, 2009; Pearlin, Schieman, Fazio, & Meersman, 2005; Stroud, Davila, & Moyer, 2008). Exposure to stress, for example, has been associated with the development or progression of a variety of conditions including anxiety, depression, asthma, arthritis, cardiovascular disease and certain cancers (Antoni et al., 2006; Chen & Miller, 2007; Cohen, Janicki-Deverts, & Miller, 2007; Miller, Maletic, & Raison, 2009; Monroe, Slavich, Torres, & Gotlib, 2007a, 2007b; Slavich, O'Donovan, Epel, & Kemeny, 2010; Slavich, Thornton, Torres, Monroe, & Gotlib, 2009). Stress has also been implicated in accelerated biological aging and early mortality (Bennett, Fagundes, & Kiecolt-Glaser, 2013; Epel et al., 2004; Lutgendorf et al., 2012; Nielsen, Kristensen, Schnohr, & Grønbaek, 2008; O'Donovan, Slavich, Epel, & Neylan, 2013).

Given the centrality of these concepts to psychology and the relevance of these effects for students' lives, it is not surprising that some high schools and many universities offer a course that discusses how stress affects health. Recently, it was proposed that such courses can maximize their impact on student development by employing an approach to classroom instruction called *transformational teaching*, which involves 'creating dynamic relationships between teachers, students, and a shared body of knowledge in a way that promotes student learning and personal growth' (Slavich & Zimbardo, 2012, p. 576). Two methods used for transformational teaching involve (a) having students participate in experiential lessons that transcend the boundaries of the classroom and (b) promoting opportunities for preflection and reflection (Slavich, 2005, 2006, 2009; Slavich & Zimbardo, 2012). Although seemingly sensible, applying this approach to courses on stress and health has been difficult given that, until recently, no structured system existed for collecting information about the different types of stress that people experience over the life course. Several state-of-the-art measures have been developed for assessing stress exposure over relatively short periods, such as 1–2 years (e.g. Adrian & Hammen, 1993; Brown & Harris, 1978; Dohrenwend, Raphael, Schwartz, Stueve, & Skodol, 2013). Given the depth of assessment involved, however, these systems do not adapt well to measuring stress over the life course. As such, there has been no way for students to easily review the different stressors that might play a role in shaping their lifespan health trajectory.

The development of the Stress and Adversity Inventory (STRAIN) has been important in this regard because it systematically inquires about 96 different stressors that can occur across the lifespan and that are known to affect health (Slavich & Epel, 2010). The types of stress covered by the STRAIN include acute life events such as relationship break-ups, deaths, job losses and negative health events, as well as chronic difficulties such as ongoing work, relationship, housing and financial problems. Users are asked whether they experienced each stressor, and if so, they are asked a series of follow-up questions designed to ascertain the exact severity, frequency, timing and duration of the stressor. This 'interview' is administered entirely online and takes approximately 25–35 min to complete in student populations. On the basis of the information collected, the system can produce more than 100 individual-level and group-level stress summary scores and life charts, making the STRAIN useful for teaching, research and clinical purposes (Slavich & Epel, 2010).

The purpose of the present study was to examine the pedagogical efficacy of using the STRAIN for teaching students about the conceptualization and measurement of life stress and how stress affects health. We were particularly interested in whether the STRAIN could be used to facilitate the transformational teaching goals of promoting experiential learning in the service of increasing students' mastery of key course concepts (Slavich & Zimbardo, 2012). To accomplish this, we integrated the STRAIN into two existing undergraduate courses. The first course was 'Stress, Coping, and Well-Being', which is an upper-level laboratory course, and the second course was 'Personal Fitness and Wellness', which is a lower-level general education course. In each instance, the STRAIN was used as an experiential activity that was intended to teach students about how stress is conceptualized and assessed in the context of health. The main outcome of interest was limited to students' knowledge of life stress—specifically, its conceptualization, measurement and effects on health. However, we imagine that experiential activities that utilize the STRAIN may also help foster personal insight and growth, as students consider the indelible mark that stress can make on their lives and the importance of employing all available resources for dealing with life's challenges (e.g. coping skills, social networks, health professionals and spiritual guidance). Stress takes a tremendous toll on students' well-being (Pryor et al., 2012; Westefeld et al., 2005). In addition, it is estimated that less than 25% of college students who require treatment for a psychiatric or drug-related disorder seek professional help (Blanco et al., 2008). Learning activities that improve stress-related knowledge while simultaneously promoting personal mental health awareness thus meet a very important set of goals.

To examine the pedagogical efficacy of using the STRAIN for teaching concepts related to stress and health, we conducted two randomized, controlled experiments with a repeated-measures component. Study 1 examined whether completing the STRAIN, coupled with participating in a related lecture and discussion, is an effective pedagogical tool for teaching students about how stress is conceptualized and assessed in the context of health. Study 2 attempted to replicate the findings from Study 1 while disentangling the effects of completing the STRAIN from those of participating in the lecture and discussion. We describe these two studies in the following text.

Study 1

Conceptualizing and assessing life stress is a complex process, given that stressors come in different forms (e.g. acute versus chronic) and can be categorized along several different dimensions (e.g. timing of exposure, life domain in which a stressor occurs and social-psychological characteristics of the stressor) that may have different implications for health (Keller, Neale, & Kendler, 2007; Kendler, Hettema, Butera, Gardner, & Prescott, 2003; Monroe & Slavich, 2007; Monroe, Slavich, & Georgiades, 2009; Muscatell, Slavich, Monroe, & Gotlib, 2009). To provide students with a first-hand experience of this conceptualization and measurement process, we conducted a randomized, wait-list controlled experiment in which two groups of students completed the STRAIN and participated in a related lecture and group discussion, in a time-lagged fashion. We hypothesized that this educational experience would lead to significant improvements in students' knowledge about how stress is conceptualized, assessed and related to health.

Method

Participants—Participants were 20 students (14 women and 6 men) enrolled in a 'Stress, Coping, and Well-Being' course during the fall semester of 2012. All participants were junior and senior psychology majors. They completed the STRAIN as an experiential component of the course and, therefore, were not given any additional course credit or financial incentive.

Stress and Adversity Inventory—The STRAIN is an online stress assessment system that measures individuals' lifetime exposure to different types of stress that can affect health (Slavich & Epel, 2010; http://www.uclastresslab.org/STRAIN). The system was developed by the first author and is intended to combine the reliability and sophistication of an interview-based measure of stress with the simplicity of a self-report instrument. To accomplish this, users are presented with one question at a time. Questions appear on a computer screen and can also be read aloud. Users, in turn, register their responses by touching their answer on the computer screen (i.e. if a touch-enabled screen is being used) or by clicking their answer with the computer mouse. As noted previously, for each stressor that is endorsed, users are asked a series of follow-up questions that ascertain the severity, frequency, timing and duration of the stressor. Because the questions are written in colloquial English, the STRAIN can be self-administered by participants or can be administered by an interviewer who simply reads the on-screen prompts. In either case, access to the STRAIN is gained by following a password-protected web link that only users or the STRAIN interviewer can view, and all data are stored anonymously on a secure Internet server that only the system administrator can access (Slavich & Epel, 2010).

The version of the STRAIN used in the present study (Version 1.4) enquires about 96 different stressors, including 66 acute life events and 30 chronic difficulties. The stressors cover all major life domains (e.g. health, intimate relationships, friendships, children, education, work, finances, housing, living conditions and crime) and focus on types of experiences that have a moderate base rate in young adult and adult populations. An example of a life event question reads: 'Have you ever found out that a partner was unfaithful to you?' An example of a chronic difficulty question reads: 'Have you ever looked for a job for at least six months, but were unable to find a stable job?' Stressors were originally identified for possible inclusion on the basis of four strategies: (a) an exhaustive literature search for major life stressors that have been linked with health; (b) individual and group consultation sessions with external experts who specialize in the conceptualization and assessment of life stress; (c) consensus judgments from a team of life stress rating experts trained in a gold-standard, interview-based system for assessing life stress (i.e. the Life Events and Difficulties Schedule; Brown & Harris, 1978); and (d) a comprehensive review of all existing state-of-the-art, interview-based measures of life stress. All questions underwent extensive review and revision to translate them into the language format of the

STRAIN. In the end, this iterative process yielded 96 core questions. The validity of this question set has been demonstrated in the context of predicting metabolic health (Kurtzman et al., 2012), cancer-related fatigue (Bower, Crosswell, & Slavich, in press) and psychological and physical health (Slavich & Epel, 2013).

Learning quiz—To examine the influence of completing the STRAIN and participating in a related lecture and group discussion on students' knowledge about stress, participants completed an 11-item quiz that assessed their understanding of topics related to the conceptualization and measurement of life stress and the effects that stress has on health. The quiz was developed for the purpose of assessing learning gains resulting from completing the STRAIN, coupled with participating in a related lecture and discussion. The pedagogical approach to this topic emphasized the conceptualization and measurement of life stress and the association between stress and health. For the quiz to have content validity, therefore, we developed 11 items that assessed students' knowledge of these topics. Of the 11 items, two addressed the conceptualization of stress, two addressed the assessment of stress, three addressed assessing life stress using the STRAIN and four addressed the effects of stress on health. Example quiz items include the following: (1) 'Life stress has been assessed in which of the following ways? (a) paper and pencil checklists, (b) interviews, (c) computer-based systems, (d) all of the above (*correct answer*), or (e) none of the above'; and (2) 'Stressful life events that occur in ____ may have a more devastating impact on health than stressful life events that occur in ____: (a) childhood – adulthood (*correct answer*), (b) finances – relationships, (c) men –women, (d) all of the above'. According to Cronbach (1990), content-valid tests cover the information the teacher wants to teach. The present quiz, therefore, possesses high content validity because it was created for the specific purpose of evaluating learning that would be expected to occur from completing the STRAIN and participating in a related lecture and discussion.

Design and procedure—We utilized a randomized, wait-list controlled experimental study design to test whether completing the STRAIN, coupled with a related lecture and group discussion, enhanced students' knowledge about stress and health. All class members received an email with instructions on how to complete the STRAIN, which they did within approximately 24 h. Students' results were recorded but not presented to students. Two days later, class was held, and half of the students (N = 10) were randomly assigned to immediately hear a lecture and discuss their experiences completing the STRAIN. This lecture and discussion lasted 25 min and reviewed the conceptualization and assessment of stress, the content and structure of the STRAIN and the types of stress that were most frequently reported by students (i.e. overall, class-averaged STRAIN results). No personal data were discussed, but students were given the opportunity to review their individual results in private, with the professor, after the study was completed. Meanwhile, students randomly assigned to the wait-list group (N = 10) were escorted to a separate room and asked to sit quietly and not interact with other students. After testing was finished with the immediate lecture group, students in the wait-list group participated in the lecture and discussion. We anticipated that the STRAIN would offer only limited benefit by itself. Therefore, participants in the immediate lecture/discussion group completed the 11-item quiz after the STRAIN but before the lecture and discussion and then again after the lecture and discussion. Participants in the wait-list control condition, in contrast, completed the quiz after the STRAIN (i.e. same time as the immediate lecture/discussion group), for a second time after the wait period and for a third time after participating in the lecture and discussion.

Data analyses—Analyses were conducted using SPSS 19.0 (SPSS Inc., Chicago, IL, USA). A 2 × 2 mixed-model repeated-measures analysis of variance (ANOVA) was used to test for changes in students' stress-related knowledge as a function of completing the STRAIN and participating in the related lecture and group discussion. We examined statistically significant Group × Time interactions using simple effects analyses that were designed to test for changes in knowledge both within each group across time and between the two groups at each time point. Alpha was set at $p < 0.05$ for all tests, and all data were examined for adherence to statistical assumptions prior to conducting these tests.

Results

We hypothesized that completing the STRAIN and discussing and reflecting on the experience would lead to significant improvements in students' knowledge about stress and health. The mixed-model ANOVA designed to test this hypothesis revealed a significant Group × Time interaction effect, $F(1,18) = 55.75$, $p < 0.001$, $\eta^2 = 0.76$ (Figure 1). As expected, students who completed the STRAIN and participated in the immediate lecture and group discussion exhibited significant increases in knowledge about stress and health from before the lecture and discussion ($M = 6.30$; $SD = 1.16$) to after the lecture and discussion ($M = 9.80$; $SD = 1.40$), $F(1,9) = 53.78$, $p < 0.001$, $\eta^2 = 0.86$. A similar improvement in stress and health-related knowledge was found for participants in the wait-list control group after they completed the STRAIN and the related lecture and discussion (pre-lecture/discussion: $M = 6.50$; $SD = 1.18$ versus post-lecture/discussion: $M = 10.00$; $SD = 0.94$), $F(1,9) = 49.00$, $p < 0.001$, $\eta^2 = 0.85$.

Additional evidence for the pedagogical efficacy of coupling the STRAIN with a related lecture and discussion was obtained by examining between-group differences. Whereas students who participated in the lecture and discussion immediately after completing the STRAIN and those in the wait-list control group did not differ in terms of their stress and health-related knowledge *prior* to the lecture and discussion, $F(1,18) = 0.60$, $p > 0.05$, $\eta^2 = 0.03$, students in the immediate lecture and discussion group did exhibit more knowledge ($M = 9.80$; $SD = 1.40$) than those in the wait-list condition who had not yet participated in the lecture and discussion ($M = 6.50$; $SD = 1.18$), $F(1,18) = 32.56$, $p < 0.001$, $\eta^2 = 0.64$, thus underscoring the potential importance of both completing the STRAIN *and* discussing the experience.

Discussion

This study shows that completing an online stress assessment, coupled with a related lecture and discussion on life stress, leads to significant improvements in students' knowledge about the conceptualization, assessment and health consequences of stress. This effect was replicated in two groups of students, in a time-lagged fashion, and in each case, the effect sizes were relatively large (i.e. $\eta^2 = 0.85–0.86$). As a result, we conclude that the STRAIN may be used in combination with a related lecture and discussion to enhance students' knowledge of stress and health.

The main limitation of Study 1 is that it cannot separate the effects of completing the STRAIN from those of the lecture and discussion. Although one might reasonably expect the lecture to independently influence learning, there is no *a priori* reason to expect that completing a life stress measure would, in and of itself, enhance knowledge about stress and health. Nevertheless, students' baseline scores (assessed after STRAIN completion but before the lecture/discussion) were relatively high, indicating that substantive learning may have occurred as a result of merely completing the STRAIN. Examining this issue requires separating the effects of completing the STRAIN from participating in the lecture and discussion. This, therefore, was the primary purpose of Study 2.

Study 2

The goal of Study 2 was to replicate the results of Study 1 showing that listening to a STRAIN-specific lecture and completing the STRAIN leads to significant learning gains. In addition, we sought to extend the results of Study 1 in three ways. First, to permit a basic examination of the psychometric properties of the learning quiz, we conducted Study 2 in a larger course, with a larger sample. Second, to examine the effect the STRAIN itself has on learning, we assessed baseline learning *before* students completed the STRAIN (or a control task, see below) instead of after. Third, to separate the influences of the experiential activity from those of the lecture content, we utilized a 2(STRAIN activity versus control activity) × 2 (STRAIN-specific lecture versus general stress lecture) × 2 (pre-quiz versus post-quiz) study design. This involved randomizing students into one of four groups: (a) STRAIN activity plus STRAIN-specific lecture; (b) control activity plus STRAIN-specific lecture; (c) STRAIN activity plus general stress lecture; and (d) control activity plus general stress lecture. Consistent with the results of Study 1, we hypothesized that students who completed the STRAIN and viewed the STRAIN-specific lecture would demonstrate the greatest learning gains, whereas students who completed the control activity and viewed the general stress lecture would exhibit the least learning gains. To explore possible benefits associated with either completing the STRAIN *or* viewing a STRAIN-specific lecture, we also examined the learning gains for students who received either one of these learning modules but not both (i.e. groups (b) and (c) described above).

Method

Participants—Participants were 144 students (81 women and 63 men) enrolled in a 'Personal Fitness and Wellness' course during the fall semester of 2012. Students were from a variety of majors and included 117 freshman, 21 sophomores, 3 juniors and 3 seniors. They completed the STRAIN as an experiential component of the course and, therefore, were not given any additional course credit or financial incentive.

Stress and Adversity Inventory—The online version of the STRAIN used in Study 2 was identical to the system used in Study 1.

Learning quiz—Student learning was assessed using the same quiz that was employed in Study 1. However, the larger sample size of Study 2 afforded an opportunity to examine some preliminary psychometric characteristics of the quiz. More specifically, we evaluated the factor structure and internal consistency of the quiz by analysing the post-activity/lecture scores for the entire sample (n = 144). We focused on participants' post-activity/lecture scores because their pre-scores amount to random guessing and, therefore, are not useful for these purposes. Because the quiz generates dichotomous responses, it was parcelled into three 3-item parcels and one 2-item parcel yielding a total of four parcels. Items were assigned to parcels randomly. Item parcels possess desirable characteristics and help to circumvent the issue of non-normality with dichotomous indicators in confirmatory factor analysis (De Bruin, 2004; Little, Cunningham, Shahar, & Widaman, 2002). The four item parcels were submitted to a confirmatory factor analysis using maximum likelihood estimation to test the unidimensional structure of the quiz. Results suggest that the quiz was unidimensional in structure, $\chi^2(2, N = 144) = 2.11$, $p > 0.05$, RMR = 0.01, CFI = 1.00, RMSEA = 0.02, and all parcels' standardized loadings were moderate to large (0.52–0.71). Examining the internal consistency of the quiz revealed an acceptable level ($\alpha = 0.65$) for a measure with only 11 items.

Design and procedure—We utilized a three-factor repeated-measures study design to test how experiential activity type and lecture content influenced learning. Students were randomized into one of the four groups described earlier, which involved receiving different sets of materials in an online environment using the survey website Qualtrics. The online activity consisted of completing either the STRAIN or, as a control activity, the 100-item Five-Factor assessment provided by the International Personality Item Pool (IPIP; Goldberg, 1992). The IPIP was chosen as a control task because it requires about the same amount of time to complete as the STRAIN but offers little-to-no opportunity for experiential learning about life stress. This activity was followed by viewing online lecture slides (i.e. STRAIN-specific lecture or general stress lecture) that were studied by each student at his or her own pace. Both lectures covered the following topics: (a) conceptualization and definition of life stress; (b) assessment of life stress; and (c) connections between life stress and health. In addition to these topics, the STRAIN-specific lecture also included information about how stress is conceptualized and assessed in the context of the STRAIN system. These topics were selected on the basis of the learning objectives of the lesson. It took students 32 min (on average) to study the slides. To test for changes in students' knowledge about stress and health as a result of these exercises, students in all four experimental groups completed the 11-item quiz described earlier both before and after the assignment. Hence, all participants progressed through the study in the following order: (1) pre-quiz; (2) randomly assigned activity (STRAIN or control activity); (3) randomly assigned lecture (STRAIN-specific lecture or general stress lecture); and (4) post-quiz.

Data analyses—Analyses were conducted using SPSS 19.0. A 2(STRAIN activity versus control activity) × 2(STRAIN-specific lecture versus general stress lecture) × 2(pre-quiz versus post-quiz) mixed-model repeated-measures ANOVA was used to test for pre/post-changes in learning and to compare these changes across the activity type and lecture content groups. A statistically significant three-way interaction of Activity Type × Lecture

Content × Time was followed by examining two-way ANOVAs, which were then followed with simple effects tests that examined changes across time within each experimental group. Alpha was set at $p < 0.05$. All data were examined for adherence to statistical assumptions prior to conducting these tests.

Results

The mixed-model repeated-measures ANOVA revealed a statistically significant three-way interaction effect, $F(1,140) = 6.50$, $p = 0.01$, $\eta^2 = 0.04$ (Figure 2). To decompose this three-way interaction, we examined the two-way interactions, which revealed that students who completed the STRAIN activity showed one pattern of learning gains that was differentiated by lecture type, $F(1,70) = 13.16$, $p = 0.001$, $\eta^2 = 0.16$ (top panel of Figure 2), whereas students who completed the control (IPIP) activity showed another pattern of learning gains that was differentiated by lecture type, $F(1,70) = 52.46$, $p < 0.001$, $\eta^2 = 0.43$ (bottom panel of Figure 2). As predicted, simple effects tests showed that completing the STRAIN and viewing a STRAIN-specific lecture led to significant learning gains, $F(1,34) = 40.69$, $p < 0.001$, $\eta^2 = 0.55$. Students who completed the control activity and viewed a STRAIN-specific lecture also exhibited significant learning gains, $F(1,35) = 118.90$, $p < 0.001$, $\eta^2 = 0.77$. Although these learning gains were greater for students who completed the control activity and viewed a STRAIN-specific lecture compared with those who completed the STRAIN and viewed a STRAIN-specific lecture, these two groups did not differ in terms of their post-activity/lecture quiz scores, $F(1,70) = 1.46$, $p > 0.05$, $\eta^2 = 0.02$. Students who completed the STRAIN and viewed a general stress lecture also showed significant learning gains, $F(1,36) = 4.16$, $p < 0.05$, $\eta^2 = 0.10$, but these gains were greater for students in the STRAIN-specific lecture and STRAIN activity group, $F(1,70) = 32.57$, $p < 0.001$, $\eta^2 = 0.32$, and for those in the STRAIN-specific lecture and control activity group, $F(1,71) = 68.49$, $p < 0.001$, $\eta^2 = 0.49$. In contrast, completing the control activity and viewing the general stress lecture did not impact learning, $F(1,35) = 0.03$, $p > 0.05$, $\eta^2 = 0.001$. The descriptive data for these effects are presented in Table I.

Discussion

The results of Study 2 replicate those from Study 1, which revealed that combining the STRAIN with a STRAIN-specific lecture significantly improves students' knowledge about the conceptualization, measurement and health consequences of stress. In addition, though, these results extend those of Study 1 by demonstrating that completing the STRAIN (and viewing a general stress lecture) *and* viewing a STRAIN-specific lecture (and completing a control task) are each sufficient for promoting learning. It should be underscored that the learning gains obtained from the STRAIN-specific lecture, irrespective of the activity completed, exceeded those of simply completing the STRAIN. Nevertheless, completing the STRAIN and viewing an online general stress lecture offered a unique contribution to learning. In contrast, simply viewing an online general stress lecture did not improve students' knowledge about the conceptualization, measurement and health consequences of stress.

Perhaps the most interesting finding from Study 2 is that students exhibited significant gains in stress and health-related knowledge when the STRAIN was paired with a general lecture on life stress (Table I, row 2). However, similar gains in learning were not evident when the general stress lecture was paired with the control (IPIP) task (Table I, row 4). Instructors who typically give a general lecture about stress and health may thus be able to promote additional learning by simply adding to their course a brief experiential activity that involves completing the STRAIN. Since students can complete the STRAIN at home and in about 30 min, this activity is not particularly time consuming and has several benefits including the fact that it enhances students' stress-related knowledge, gives students the opportunity to personally experience the complexities involved in conceptualizing and assessing stress and gives students some insight into their own personal stress exposure history.

An important caveat to Study 2 is that it was conducted entirely online. As such, students were not sitting together in a classroom, which would have enabled them to discuss the lecture content with each other and with the instructor. This can be seen as a limitation, but it may also suggest that the learning gains observed may be even more pronounced in a traditional classroom setting, such as the one employed in Study 1. Nevertheless, Study 2 demonstrates that even when this in-person learning opportunity is not available and the online environment is the only medium of instruction, the STRAIN activity still offers an instructional advantage.

The main limitation of Study 2 is that it cannot elucidate the specific factors that led to student learning. Several factors are possible. For example, simply by completing each item on the STRAIN, students may have learned that stress has multiple dimensions and can occur in several different life domains. Another learning moment is likely when students realize that several follow-up questions get prompted for each stressful experience they endorse while completing the STRAIN. As such, students may come to understand that the mere presence or absence of a stressor only tells part of the story. In fact, the actual impact that a stressful experience has on health is also determined by a stressor's frequency, timing, duration and severity (Monroe & Johnson, 1990; Monroe et al., 2009). Regardless of the precise reasons for why learning occurs, though, we believe the findings from Study 2 indicate that the STRAIN is an effective tool for promoting learning and that it can be easily added to a traditional lecture on stress and health to enhance students' knowledge of these important concepts.

General discussion

The question of how stress affects mental and physical health is relevant for everyone but particularly important for college students, given that 19.3% of male students and 40.5% of female students feel emotionally overwhelmed by their demands (Pryor et al., 2012). Although these negative experiences can presage the development of several problems including excessive drinking, depression and physical illness (Ham & Hope, 2003; Harkness et al., 2010; Poltavski & Ferraro, 2003; Taylor, 2010), stress and health is a readily teachable topic, and multiple interventions have been found to improve students' academic performance and health (e.g. Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001; Walton & Cohen, 2011; for a review, see Yeager & Walton, 2011). The goal of the present research was relatively modest in this regard—namely to examine the utility of using an automated measure of life stress for teaching students about stress and health. Nonetheless, the findings were encouraging. Across two randomized, controlled experimental studies and more than 160 students in both upper-division and lower-division classes, we found that completing an automated measure of life stress (i.e. the STRAIN) and listening to a related lecture significantly improved students' understanding of stress and health. When we sought to identify whether these effects were due to completing the STRAIN or participating in a STRAIN-related lecture (Study 2), we found that although viewing a lecture on the STRAIN was sufficient for promoting learning, pairing the STRAIN with a traditional lecture on stress also improved students' knowledge of stress and health. In effect, therefore, using the STRAIN as an experiential teaching tool can lead to significant learning gains even when instructors only pair the STRAIN with a traditional lecture on stress and health. This likely occurs because by simply completing the STRAIN, students are exposed to several concepts related to the conceptualization and assessment of life stress. As such, employing the STRAIN as a teaching tool may be particularly useful for teachers who are not experts in the assessment of stress.

The main strength of these two studies is the use of randomized, controlled, experimental study designs to examine the effects that an experiential teaching activity has on student learning. Despite long-standing calls for more high-quality research on pedagogical techniques (Bassey, 1995; Pearson, 1911; Slavin, 2002; Torgerson & Torgerson, 2001, 2007), studies that employ random assignment and experimental methods are still relatively rare in the educational psychology and teaching of psychology literature. Moreover, we are personally unaware of any randomized, controlled, experimental studies that have examined the efficacy of teaching activities that are directly relevant for courses on stress and health. We thus echo the previously identified need for additional high-quality research that examines the potential benefits of integrating experiential activities into course curricula. Studies that employ these methods for improving courses on stress and health may be particularly impactful, given the critical relevance and importance of these topics for students' well-being.

Several limitations of these two studies should also be noted. First, because our goal was to examine the effects of pairing the STRAIN with a related lecture and discussion, these studies do not address the possible benefits that may be associated with completing the STRAIN as a stand-alone activity. Consistent with a transformational teaching approach to classroom instruction (Slavich, 2005; Slavich & Zimbardo, 2012), we view the STRAIN as a tool, or vehicle, for teaching concepts related to stress and health. The STRAIN can also help foster class discussions about how stress impacts health. Because the STRAIN itself is not a teaching instrument, though, our position is the lecture and classroom discussion components of this lesson are a critical aspect of the learning experience. Nonetheless, future research could examine the independent learning gains attributable to completing the STRAIN alone. Second, both of these studies utilized samples of students who attend a college with limited ethnic, racial, age and socio-demographic diversity. Additional research is thus needed to examine the generalizability of the present findings. Finally, although we have suggested that employing the STRAIN may represent an experiential learning activity that is consistent with the goals of transformational teaching, we focused our pre-STRAIN and post-STRAIN assessments on stress-related content only and did not evaluate whether the STRAIN enhances transformational teaching-related concepts such as students' attitudes, values, beliefs or skills. As such, future studies should examine whether completing the STRAIN, and engaging in a discussion of one's personal results, might improve students' ability to identify stress in their lives, change their attitudes towards stress and health or enhance their beliefs about the importance of living a healthy lifestyle. Measuring these outcomes requires more extensive assessment (e.g. using interviews, or short-answer or essay questions), but the upside would be a deeper understanding of the ways in which experiential activities that utilize the STRAIN affect student learning and development.

In conclusion, we suggest that the STRAIN is an effective pedagogical tool for teaching undergraduate students about the conceptualization and assessment of life stress in the context of health. Integrating the STRAIN into a tailored (or even a traditional) lecture on stress and health also provides students with an opportunity to learn about how stress impacts their well-being, which could in turn serve as the basis for additional insight and personal development. Given that stress can profoundly influence a person's mental and physical health (Miller & Chen, 2010; Slavich & Cole, 2013; Slavich, Monroe, & Gotlib, 2011), experiential activities that enhance students' knowledge about stress-related concepts may not only promote learning but also have the ability to improve students' lives.

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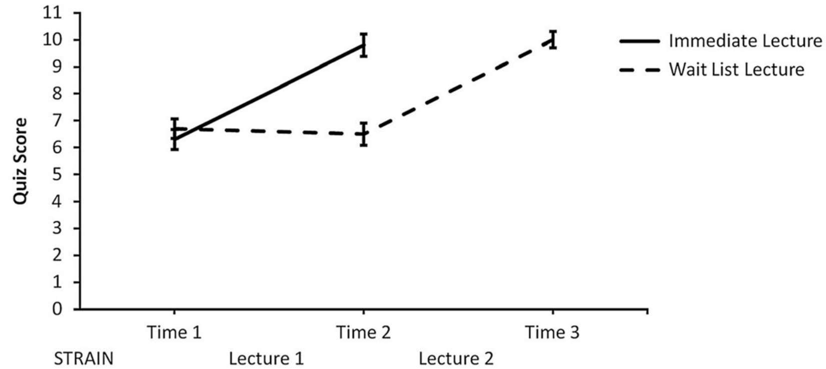

Figure 1.

Learning gains resulting from completing the STRAIN, and participating in a related lecture and group discussion, in a randomized, wait-list controlled experiment. Completing the STRAIN and participating in a related lecture and group discussion on life stress led to significant improvements in students' knowledge about the conceptualization, assessment and health consequences of stress. Error bars represent standard errors (*n* = 20)

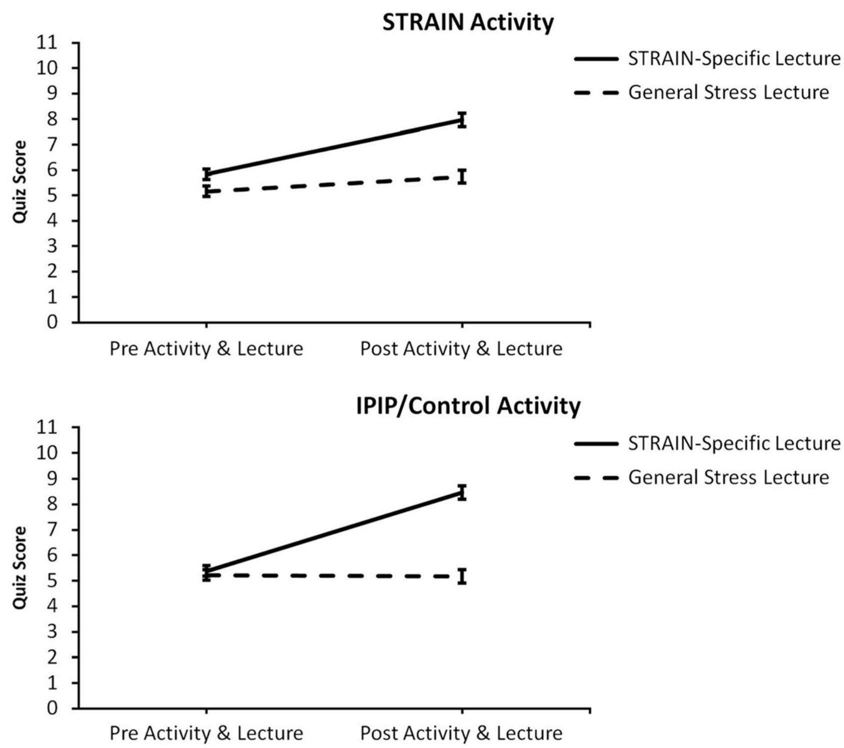

Figure 2.

Learning gains resulting from a 2 × 2 × 2 repeated-measures experimental study in which students were randomly assigned to complete an experiential learning activity (STRAIN activity or control activity) and view an online lecture (STRAIN-specific lecture or general stress lecture). Completing the STRAIN and viewing the STRAIN-specific lecture resulted in statistically significant learning gains. Students who viewed the STRAIN-specific lecture and completed the control task *and* students who completed the STRAIN and viewed a general stress lecture also exhibited significant improvements in learning, suggesting that pairing the STRAIN with a traditional lecture on stress is sufficient for promoting learning. In contrast, simply viewing an online general stress lecture did not impact learning. Error bars represent standard errors (n = 144)

Table I

Learning gains by experimental group

Experimental group	Pre-activity/lecture quiz score		Post-activity/lecture quiz score			
	M	*SE*	*M*	*SE*	*F*	η^2
STRAIN activity						
STRAIN-specific lecture	5.83	0.20	7.97	0.33	40.69★★★	0.55
General stress lecture	5.16	0.20	5.73	0.22	4.16★	0.10
IPIP/control activity						
STRAIN-specific lecture	5.39	0.18	8.47	0.25	118.90★★★	0.77
General stress lecture	5.22	0.24	5.17	0.23	0.03 *ns*	0.001

M: Mean; *SE*: Standard Error.

ns $p > .05$;

★ $p < .05$; and

★★★ $p < .001$.