A cultural comparison of mindfulness and student performance: Evidence from university students in five countries

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Abstract: Societal and cultural norms are important in shaping how individuals live, study, and work. Of particular interest in recent research is the role of mindfulness, defined as the ability to focus on the present moment, and how it can impact cognitive function and productivity. This study examines the relationship between scholastic achievement and mindfulness among university students in China, Finland, Germany, South Africa, and the United States. Comparisons between countries with respect to self-reported measures of mindfulness, test anxiety levels, and phone usage are analyzed. These measures are used to determine whether mindfulness affects student performance in introductory economics classes. We provide evidence that a positive association between mindfulness levels and student performance exists, but the relationships vary significantly across countries.

Keywords: Mindfulness; self-awareness; cultural comparisons; learning outcomes

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1. Introduction

Technological devices such as smartphones and tablets have changed the way individuals communicate, study, and work. In higher education, these devices have generated new and innovative methods of engagement, collaboration, and learning, which became even more important when COVID-19 forced many institutions to rely more on remote learning. But technological devices can also be a source of distraction that causes students to lose focus on the task at hand. The consequences associated with a technology-driven society have generated a large amount of interest and scientific inquiry into the effects of mindfulness, which is defined as self-awareness and attention to one's experience in the present moment (Bishop *et al* 2004). In this paper, we study the effects of mindfulness on academic outcomes among university students in five countries across four continents to better understand how students may benefit from efforts to improve one's mindfulness.

To be mindful, one must be able to focus on the present activity at hand without distractions, which runs counter to the pursuit of multitasking. Chiang and Sumell (2019) showed that the lack of mindfulness can affect a student's ability to learn and retain information, which results in poorer academic performance. Their results align with psychological research showing that the cognitive switching costs associated with multitasking can reduce performance (Junco and Cotten 2012; Lottridge *et al* 2015), exacerbate stress levels (Lepp *et al* 2014; Rubinstein *et al* 2001), and diminish one's ability to process and retain information (Chun *et al* 2011; Clapp *et al* 2011; Koch *et al* 2011; Marois and Ivanoff 2005; Naveh-Benjamin *et al* 2000). However, few studies in any discipline have analyzed whether mindfulness affects student learning differently across countries.

This is the first major study to examine the relationship between mindfulness levels and student learning outcomes across multiple regions of the world. We collected survey data from nearly 3,000 university students in introductory economics classes in China, Finland, Germany, South Africa, and the United States. Mindfulness levels are determined by student responses to the *Mindful Attention Awareness Scale* (MAAS), which is a 15-item scale that assesses respondents' dispositional mindfulness based on their level of distraction and awareness in everyday life. We also asked students to assess their anxiety levels while taking exams, the frequency of mobile device usage during class, and the frequency of daily social media usage. Student performance is measured by course performance relative to the class mean.

Our findings show that a positive relationship between mindfulness and performance exists in most countries, but the strength of the relationship varies substantially. Among the five countries analyzed, college students in the United States had the lowest reported mindfulness levels and the highest reported levels of test anxiety, while students in China had the highest reported mindfulness levels and the lowest reported levels of phone usage during class. Finland exhibited the strongest correlation between mindfulness and performance, while students in China exhibited the weakest correlation. Compared with students in other countries, U.S. students showed a stronger relationship between performance and both phone usage and test anxiety. We explore these findings in greater depth in the remainder of this paper.

2. Background on mindfulness and higher education

There is a large amount of research on the effects of mindfulness, the vast majority of which has found that increased mindfulness is beneficial to one's mental and physical health. Previous research has shown that mindfulness is associated with reduced stress and anxiety (Bullis *et al* 2014; Cavanagh *et al* 2013; Ciesla *et al* 2012), higher self-reported well-being

(Seear and Vella-Brodrick 2013; Branstrom *et al* 2011), improved physical health (Loucks *et al* 2016; Murphy and Mackillop 2012), and enhanced productivity (Levy *et al* 2012; Langer 2014). However, research concerning the effects of mindfulness on performance among students in higher education is limited.

This paper builds upon the work of Chiang and Sumell (2019) which examined the relationship between mindfulness and performance among U.S. college students. They used a two-stage least squares model to infer causality from mindfulness to performance. They found that mindfulness affects performance and that this effect is stronger among female students and students with lower grade point averages. The present paper does not attempt to replicate their model, but rather to analyze the correlations on a larger scale, assessing students from five countries on four continents. An important benefit that arises is an improved understanding of how the effect of mindfulness interventions may depend on cultural differences. However, there are limitations in using a data set encompassing significant cultural and social differences. For example, we were unable to collect sufficient instruments that would allow us to replicate Chiang and Sumell's work. Still, this represents the first major multi-country study on mindfulness and student performance in higher education.

Additional studies of the effect of mindfulness on learning outcomes include those of Borker (2013) and Ramsburg and Youmans (2014). Borker showed that mindfulness training can be effective in technically demanding subjects such as economics, especially with respect to understanding abstract concepts. Ramsburg and Youmans found that brief exposure to meditation training (which contributes to mindfulness) improves overall knowledge retention among college students. Although these studies are promising, nearly all use data samples collected in the United States. Yet the cultural effects of mindfulness are potentially very

important in how individuals (whether they are from different countries or represent different ethnicities within a country) respond to mindfulness interventions.

Several studies have addressed cultural issues related to mindfulness. Christopher et al. (2009) compared mindfulness levels among college students between the United States and Thailand using the MAAS survey, and found students demonstrated scalar invariance between countries, but did not significantly differ in latent mean mindfulness levels. Ghorbani et al (2009) used the MAAS survey to compare university students in the United States with students in Iran, and found that mindfulness has similar psychological effects despite differing cultural values. They suggest that mindfulness can play a role in resolving intercultural conflicts.

Cultural and external factors can play a role in how mindfulness differs across countries and how it affects learning outcomes. For example, cultural characteristics may influence attitudes toward learning and grades, and external factors may influence students' ability to focus on school and to manage stress and anxiety levels. Several studies (e.g., Chang *et al* 2010; Chang and Asakawa 2003; Goodin *et al* 2013; Heine and Lehman 1995; Ji *et al* 2004) examined whether ethnic and cultural differences can have a significant influence on cognitive bias and psychological health outcomes. Chang *et al* (2010), Heine and Lehman (1995), and Chang and Asakawa (2003) found that Westerners, or non-Hispanic whites, hold higher levels of optimism compared to Easterners or individuals of Asian descent. Other studies have tested the validity of mindfulness indicators on different cultural populations. Deng *et al* (2011) administered the *Five Facet Mindfulness Questionnaire* (FFMQ) on a large sample of Chinese university students to uncover the psychometric properties of mindfulness, and found that four of five facets were consistent in predicting anxiety among students. A subsequent study on 214 French-speaking

students conducted by Heeren *et al* (2011) also found FFMQ to be valid in predicting behaviors, again suggesting that mindfulness indicators can transcend cultures.

Moreover, significant cultural diversity exists within countries, such as in the United States and in many European countries. Woods-Giscombe and Gaylord (2014) compared the effects of mindfulness on African Americans and European Americans, while Masuda *et al* (2010) focused on the impact of mindfulness on Asian Americans relative to European Americans. Both studies found that despite unique challenges faced by minority groups, increasing mindfulness leads to reduced emotional distress and overall improved well-being. Peacock and Harrison (2009) compared mindfulness levels between domestic and international students studying in the United Kingdom to uncover dynamics that occur when students from different cultures interact. They found that increasing mindfulness helps students avoid stereotyping others and improves integration, reducing what the authors called passive xenophobia.

These studies suggest that culture matters, whether within countries or across countries. This paper contributes to the literature by examining differences in dispositional mindfulness levels and its relationship with student performance across multiple countries. Specifically, we compare different measures of mindfulness based on student responses to the MAAS survey, along with reported levels of mobile phone usage, social media usage, and test anxiety, and how each of these variables correlate with student performance across countries.

3. Mindfulness survey and data

Measuring the level of mindfulness among individuals requires either the use of observational practices, such as a controlled environment in which a test group is compared to a control group, or surveys that measure mindfulness based on a self-assessment of behavior. This

study utilizes the latter approach by asking students to respond to the *Mindful Attention Awareness Scale* (MAAS), developed by Brown and Ryan (2003). Our survey included the MAAS survey along with additional questions on mobile phone and social media usage, test anxiety, academic indicators, and demographic and socioeconomic factors. The Appendix provides the complete list of survey questions, which were translated into Chinese, Finnish, and German for the respective samples and, in a few cases, slightly modified for cultural relevance.

The dataset includes 2,981 participants who were enrolled in an introductory economics course in China (323 students), Finland (96 students), Germany (130 students), South Africa (1,502 students), and the United States (930 students). Data were collected between 2015 and 2017. The courses selected to be part of this study included those of the authors as well as colleagues willing to administer the survey and report final exam and course grades. All students volunteered to take part in this research project. Table 1 provides a description and comparison of the universities and classes that were included in the sample for each country.

<Table 1>

With the exception of the U.S. sample, we did not collect data from multiple universities within each country. However, each university represented in this study has a large enrollment (ranging from 11,000 to 48,000 students) and was broadly representative of the demographics and cultural characteristics of each country. We acknowledge that cultural differences exist within countries, which we cannot directly address empirically in this paper. Our paper focuses on potential cultural differences across countries that may influence dispositional mindfulness, phone usage, and test anxiety, and their relationship with academic performance.

MAAS consists of 15 statements related to dispositional mindfulness (e.g., “I do jobs or tasks without much awareness of what I’m doing”) from which students assess how frequently

they have experiences referenced in each item using a 6-point Likert scale from almost always (1) to almost never (6). MAAS has been used widely to measure mindfulness in a diverse array of clinical psychology and scientific applications, and previous research has shown the MAAS to be correlated with other psychometric measures of well-being (Baer *et al* 2006; MacKillop and Anderson 2007; Hansen *et al* 2009).

In asking students to respond to each MAAS statement using a Likert scale, students were instructed to evaluate each statement according to their actual experience, and not what they believe ought to be their experience. Students were also informed that their responses would be kept anonymous and confidential, and had no bearing on their performance in the course. Because car ownership was not common among students in the China and South Africa samples, MAAS statement #12 "I drive places on 'automatic pilot' and then wonder why I went there" was not included in the analysis. We therefore calculate the MAAS index based on the remaining 14 statements.

We complement the MAAS survey with additional questions related to mindfulness such as mobile phone usage during class and an assessment of one's level of test anxiety. Specifically, students were asked to assess the statements, "I find myself checking my phone or tablet during a typical class" and "I feel anxious when taking exams" using the same 6-point Likert scale described above (where higher numbers represent less phone usage and less anxiousness to be consistent with MAAS). Although the use of mobile devices was discouraged in all classes in the sample, they were not explicitly banned. Test anxiety can be attributed to a number of factors, including fear of failure (Rothblum 1990) or the inability to focus on the task at hand.

These additional measures assess different factors on performance, and the implications of the estimates depend on their relative significance. The MAAS Index is a measure of general

mindfulness, as in how one assesses his or her overall distraction levels on a day-to-day basis. The Phone Index is an assessment of mindfulness specific to the classroom, while the Anxiety Index is an assessment of mindfulness specific to the exam environment. All of the mindfulness statements along with summary statistics for the five country samples are shown in Table 2.

<Table 2>

In addition to assessing the mindfulness statements, we asked demographic questions including one's age, gender, ethnicity and race, and family status. Socioeconomic questions included the average number of hours worked per week, the number of classes taken, and, if relevant, distance and average commuting time to campus. Academic factors include class standing, grade point average (or equivalent), and field of study (actual or anticipated).

Finally, we collected data on student performance measures. These measures include overall course performance (course grade) and final exam performance. The courses students took were not uniform in format, policies, and grading mechanisms. Some of these differences are shown in Table 1. For example, some students took exams that consisted solely of multiple-choice questions while others took exams that include both multiple-choice and short-answer response questions. Moreover, the weight of the final exam on the course grade differed across samples. These differences may affect how mindfulness affects learning outcomes. Although we are unable to fully control for these varying factors, we attempt to mitigate their effects in our model by using the following strategies. First, we measure performance using relative scores; specifically, the difference between a student's percentile score and the mean percentile score of all respondents in that class. Second, we focus on a student's overall course grade as opposed to just the final exam score, because the latter may not represent the overall outcome from which

mindfulness may play a role. Lastly, we include a country-specific fixed effect in our empirical model to account for other unobserved factors.

4. Empirical model

The objective of the empirical model is to analyze how self-reported measures of mindfulness, phone usage, and test anxiety among students vary across countries, and how these measures are related to performance in an introductory economics course. Mindfulness is associated with the ability to stay focused on the task at hand. Therefore, being attentive contributes to mindfulness, while common distractions such as mobile phones and other technological devices (despite their intention to increase efficiency) may reduce mindfulness. Our aim is to study the extent by which various measures of mindfulness correlate with performance, and how these findings systematically vary across students in different countries.

Our model estimates the relationship between mindfulness and academic performance, controlling for three other categories of variables: academics, demographics, and socioeconomics. Mindfulness is measured using the MAAS index, how frequently students use mobile devices during class, and how frequently students feel anxious when taking exams. To be consistent, each of these three variables is measured with higher numbers equaling greater mindfulness (i.e., lower phone usage and less anxiousness).

Academic variables that may impact a student's scholastic ability include one's course load and class standing. Demographic variables include the student's age, gender, race, ethnicity, marital status, and an indicator for whether the student is responsible for raising a child. Other variables relating to socioeconomic conditions include whether the student works 20 or more hours per week, whether one receives financial aid, and typical commute time to campus.

Our general hypothesis is that students who are more mindful and less anxious during exams are able to focus more effectively and therefore perform better on assignments and exams, all other factors held constant. This would be reflected with a positive coefficient on the mindfulness measures in the empirical equations. However, societal and cultural factors, such as attitudes toward technology and education, mental health support services, social pressures to succeed in school, costs of college, along with differences in educational systems may influence the manner in which these variables affect student performance.

5. Results

We begin by presenting and comparing descriptive statistics across the five country samples for the mindfulness measures in Table 2. Some notable differences across countries are apparent. For example, students in the United States generally report lower dispositional mindfulness levels relative to students in other countries. With a maximum rating of 6 on the standard Likert scale, the average MAAS rating in the country samples was 3.52 in the United States, 3.76 in South Africa, 3.92 in Germany, 3.95 in Finland, and 3.99 in China.

Analyzing the 14 specific MAAS items in more detail, students in the United States reported higher average mindfulness levels relative to students in other countries in only three instances. In comparison, students in China, Finland, Germany, and South Africa report similar average mindfulness levels overall, though differences in specific items exist across countries. These may largely be due to cultural norms that impact the day-to-day habits of students.

The alternative measures of mindfulness, the reported frequency of phone usage during class and frequency of feeling anxious during exams, exhibit clear differences across countries. As noted earlier, higher values represent less phone usage and less reported anxiousness. Not surprisingly, students in Finland, which is known for its “mobile culture” (Puro 2002), report a

significantly higher frequency of using their phone during class compared to students in other countries. Test anxiety has been found to have a strong relationship with dispositional mindfulness in studies by LePera (2011) and Rasmussen and Pidgeon (2011). In our survey, the median U.S. respondent reported feeling anxious when taking exams "very frequently", while the median respondent in China and Finland reported feeling anxious "somewhat frequently".

Figure 1 presents frequency distributions of the average MAAS rating between the U.S. sample and each of the other four country samples. Figures 2 and 3 compare frequency distributions for the other two measures of mindfulness, phone usage and test anxiety, respectively. Based on these figures, the U.S. and South Africa samples are remarkably similar, with U.S. students being slightly less mindful based on MAAS but almost identical in phone usage and test anxiety.

<Figure 1>

<Figure 2>

<Figure 3>

Moreover, U.S. and South African students, on average, are significantly less mindful and report higher anxiety levels relative to students in China, Germany, and Finland. One possible factor influencing the lower mindfulness measures and higher anxiety levels among the U.S. and South Africa samples is financial stress, which has been shown to contribute to anxiety amongst college students and have a negative impact on academic performance (Joo *et al* 2008; Robb *et al* 2012). Our survey did not ask students about their financial situation, but publicly available information and previous research suggests that students in the United States and South Africa generally face greater financial stress than students in Europe or China (Boyington 2017; Hodes 2017; Montalto *et al* 2019). Most students in the Finland and Germany samples paid little

to no tuition, while students in the South Africa sample paid approximately $3,500 per year and in-state students in the U.S. sample paid between $7,000 and $10,000 per year. In addition, 76% of students in the U.S. sample worked while attending school, compared to 58% in Germany, 26% in South Africa and Finland, and 0% in China. The low percentage of working students in South Africa may reflect the country having one of the highest youth unemployment rates in the world, which likely exacerbates financial stress (Cassim and Oosthuizen 2014).

Table 3 explores the differences in mindfulness measures by gender. Average dispositional mindfulness levels measured by MAAS were higher among male students in the United States, South Africa, and Finland but higher among female students in China and Germany. Average Phone Index (in which higher numbers mean lower reported phone usage in class) was higher among males in Finland, South Africa, and the United States. Average Anxiety Index (in which higher values represent lower reported exam anxiety) was higher among males in all countries, reinforcing evidence by de Vibe *et al* (2013) who found that female college students reported higher anxiety levels on exams relative to male students. Although differences in mindfulness measures by gender were significant in certain countries, gender did not appear to significantly impact how a student's level of mindfulness affected course performance.

<Table 3>

To explore the relationship between mindfulness measures and performance, Table 4 shows the average MAAS Index, Phone Index, and Anxiety Index by relative performance quintile in each country. Table 4 suggests that dispositional mindfulness levels, as measured by the MAAS Index, were positively associated with course grades among students in all countries except Germany. The relationship between MAAS Index and grades was particularly strong

among students in Finland. The average MAAS Index was 0.69 points higher for students in the top 20% of performance compared to students in the bottom 20% of performance.

<Table 4>

The relationship between phone usage in class and performance is less generalizable across countries. Phone Index (where higher numbers mean lower reported usage) had a strong and positive relationship with student performance in the United States and South Africa, but no clear pattern in Finland and Germany, and a negative relationship in China. Interestingly, Anxiety Index (where higher numbers mean lower reported anxiety levels) had a significant positive relationship with performance in Finland, Germany, South Africa, and the United States, but a negative relationship with performance in China. The relationship between Anxiety Index and performance was particularly strong among U.S. students: Anxiety Index was 0.76 and 0.71 points higher for students in the top 20% of overall relative and final exam relative performance, respectively, compared to students in the bottom 20%.

Table 5 shows the Pearson correlation coefficients between the MAAS Index, Phone Index, and Anxiety Index across countries. Dispositional mindfulness, as measured by the MAAS Index, is more strongly correlated with test anxiety (Anxiety Index) than with the frequency of phone usage (Phone Index). The correlation coefficients between MAAS Index and Anxiety Index are statistically significant in all countries except Germany, and takes on the highest values in Finland and the United States (0.34 and 0.33, respectively). The correlation coefficient between Phone Index and Anxiety Index is approximately 0.17 and statistically significant in China, South Africa, and the United States, but in Finland and Germany the correlation is weak and not statistically significant.

<Table 5>

The relationship between performance and mindfulness levels is further explored using ordinary least squares (OLS). The OLS equation takes the following functional form:

$$P_i = \beta M_i + \alpha X_i + \rho_c + e_{i,c} \quad (1)$$

where P_i is the relative overall performance of student i, M_i is the measure of a student's mindfulness level as measured by the MAAS, Phone, and Anxiety Indexes, X_i is a matrix of covariates including social media usage, course load, course preferences, class standing, gender, marital status, children, race, distance to campus, and work hours, ρ_c is a country-specific indicator, and $e_{i,c}$ is a randomly distributed error term. To account for heterogeneity across classes, performance is measured as the difference between a student's percentage grade and the average percentage grade of the class.

Table 6 shows the means of the control variables across countries. There are substantial differences in student characteristics and behavior across samples. For example, 74% of students in the China sample indicated that they checked social media more than ten times per day, compared to only 34% of students in South Africa. Over 90% of students in the South Africa sample were freshman, resulting in a relatively young sample, while only 30% of students in the China sample were male.

<Table 6>

The OLS estimates for all countries are shown in Table 7. The coefficients are standardized to represent how a student's overall percentage grade changes relative to the class average given a one standard deviation increase in the independent variable. The results on the combined sample suggest there is a positive relationship between all three mindfulness measures and students' relative performance in class, and the coefficients on MAAS Index and Anxiety Index were statistically significant. The results suggest a one standard deviation increase in the

MAAS Index is associated with a 0.04 standard deviation improvement in student performance. Of the three mindfulness measures, Anxiety Index had the largest effect. A one standard deviation increase in Anxiety Index was associated with a 0.06 standard deviation increase in overall relative performance, while a one standard deviation increase in Phone Index was associated with a 0.03 standard deviation increase in relative performance.

The coefficient on social media, which measures whether a student checks social media ten or more times per day, is negative and statistically significant. Other factors held constant, the final average of students who indicated they use social media ten or more times per day was 0.06 standard deviations lower compared to other students, suggesting that both in-class and out-of-class distractions were negatively associated with performance.

<Table 7>

Among student-specific covariates, gender, distance to campus, and work status exhibit statistically significant coefficients in the expected direction. The performance of male students was 0.07 standard deviations lower than female students; those who lived within 10 minutes of campus performed 0.06 standard deviations higher than those who lived farther away; and those who did not work performed 0.17 standard deviations higher than those who worked 20 or more hours per week.

Table 7 also shows the OLS estimates by country. The coefficients for the dispositional mindfulness variables are positive for all countries except Germany, however statistically significant only for Finland and South Africa. A one standard deviation increase in students' dispositional mindfulness is associated with a 0.23 and 0.07 standard deviation increase in final average in Finland and South Africa, respectively. The frequency of mobile device usage during class had a significant relationship with performance only in the United States. Specifically, a

one standard deviation decrease in reported mobile device usage (measured by an increase in Phone Index) is associated with a 0.10 standard deviation increase in performance. The coefficients on test anxiety are positive and significant in South Africa and the United States. A one standard deviation decrease in reported test anxiety (measured by an increase in Anxiety Index) is associated with a 0.07 and 0.15 standard deviation increase in performance in South Africa and the United States, respectively. We speculate, without supporting evidence, that the significant coefficients on test anxiety in South Africa and the United States could be related to financial stress resulting from comparatively less government support and increasing costs of higher education (Boyington 2017; Hodes 2017).

To put our main results into perspective, the 0.04 coefficient on the MAAS Index for the overall sample can be translated into practical terms as follows. A one-unit improvement in the MAAS Index (for example, moving from "(4) Somewhat Infrequently" to "(5) Very Infrequently") would, on average, increase relative student performance by 1.1%, other factors held constant. Meanwhile, a one-unit improvement in Phone Index and Anxiety Index increases relative performance by 0.4% and 0.9%, respectively. Although these marginal effects may seem small, a modest change in a student's final average can have a meaningful impact on a student's academic record. For example, in the U.S. sample, course grades were separated by increments of 3% to 4% (e.g., D+ to C-), while in China and South Africa, a fixed percentage grade (e.g., 60% in China and 50% in South Africa) determined whether students passed or failed the course.

6. Conclusion

The role of mindfulness in society has become more prominent as research shows it to be positively associated with increased productivity, cognitive function, and reduced stress. This is especially relevant as the COVID-19 pandemic forced individuals and businesses to adapt to new

routines, often leading to greater instances of multitasking. This study examined the relationship between mindfulness and academic outcomes among students in China, Finland, Germany, South Africa, and the United States. We find that mindfulness levels vary across countries, along with its relationship with academic performance. Therefore, mindfulness intervention strategies could be tailored to student needs by understanding how different policies affect performance. For example, our results suggest that prohibiting phone usage in class may not be as effective as encouraging methods to reduce exam anxiety, such as a short breathing exercise prior to each exam.

The relationship between mindfulness and performance is generally positive across the five country samples, but the association is strongest in South Africa and the United States. Among the mindfulness measures, test anxiety has the strongest relationship with performance across all countries, but plays a greater role in South Africa and the United States than in China, Finland, and Germany. Social media usage has a negative relationship with performance in all countries except in China and the United States.

We conjecture that these differences may be the result of both cultural differences along with structural differences in higher education across countries. For example, the relatively strong relationship between mindfulness and performance in South Africa and the United States could reflect greater financial pressures among students. The relatively weak relationship between phone usage and performance in Finland and Germany might reflect that phones are more frequently used in classrooms in these countries. In China, a general cultural association with meditation may lead to a smaller marginal impact based on specific mindfulness measures.

This study has several limitations to be considered when interpreting the results. First, the data are exclusive to students studying introductory economics from a single university in China,

Finland, Germany, and South Africa, and two universities in the United States. The characteristics of students in these universities may differ from the overall student population of the country. Further research could examine the relationship between mindfulness and performance in additional universities, disciplines, and countries. The empirical models cannot measure how heterogeneity in assessment methods or class environment may impact student mindfulness levels and its relationship with performance. In addition, the investigation of specific cultural differences across and within countries, especially countries with large ethnic and racial diversity, are valuable avenues for future research.

The findings of this study suggest that mindfulness can be an important goal toward improving learning in the classroom. Instructors can encourage mindfulness by engaging in active learning methods that help students stay focused on course content and being more innovative with the use of mobile devices by allowing these devices to complement learning instead of serving as a distraction. Examples of activities that may satisfy these objectives include the use of polling software to keep students focused on content, or think-pair-share strategies where students engage in peer learning in small groups in person or online. At the institutional level, universities can offer mindfulness workshops and training to faculty and students in order to encourage them to apply mindfulness skills to their own lives and in the classroom. Regardless of the approach, findings ways to improve one's mindfulness can lead to a more focused and productive environment, no matter the classroom or country in which one is present.

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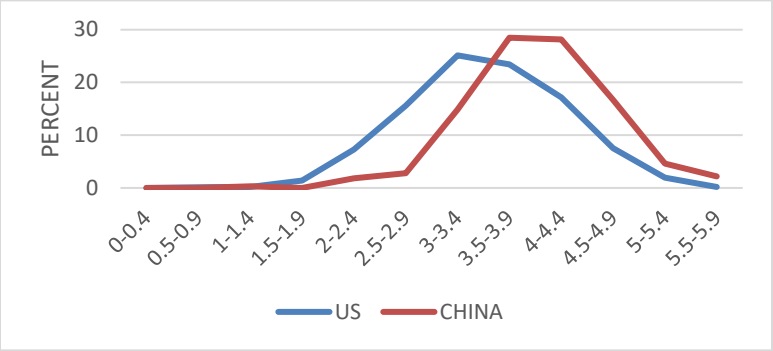
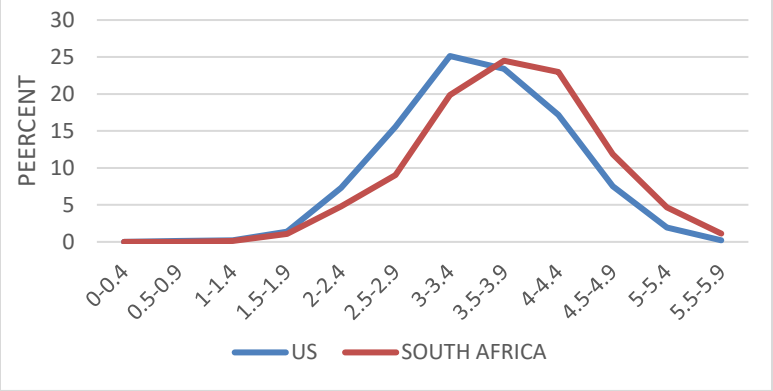
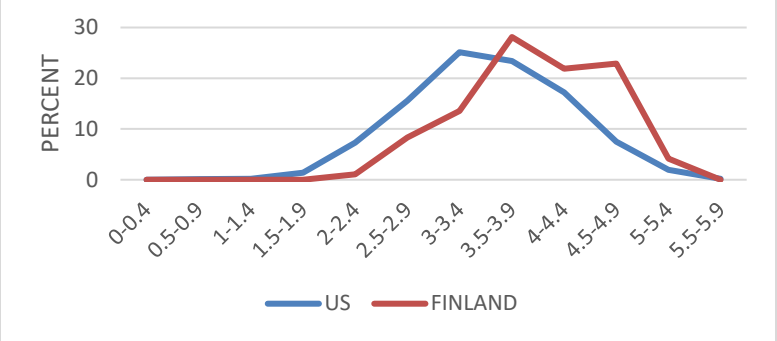
Figure 1: Relative frequency distribution tables. Variable = MAAS Index (U.S. vs. other countries).







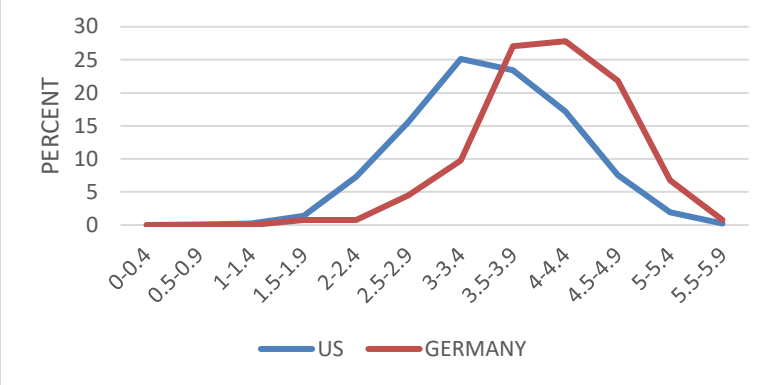
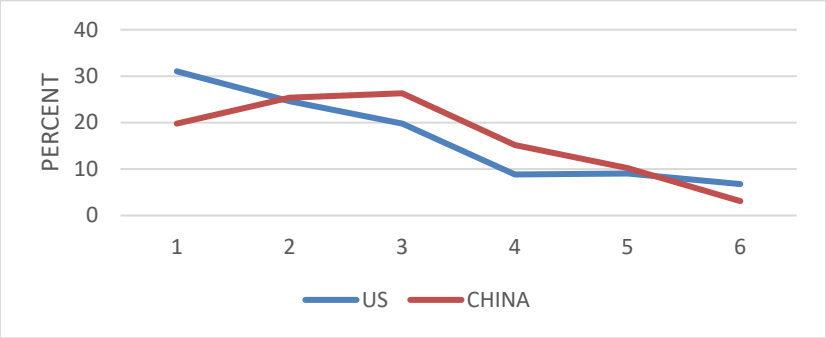
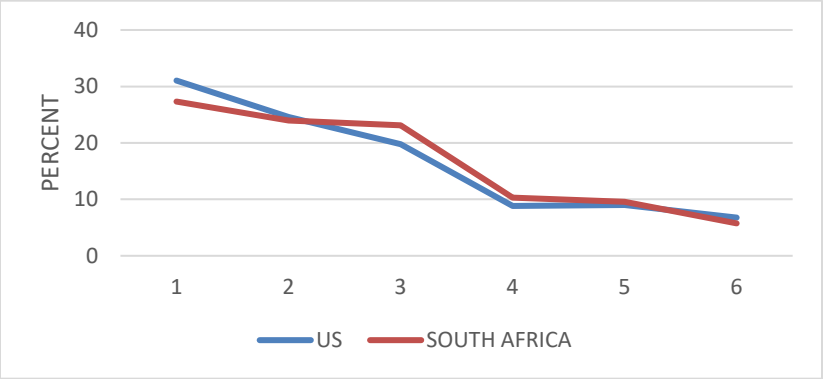
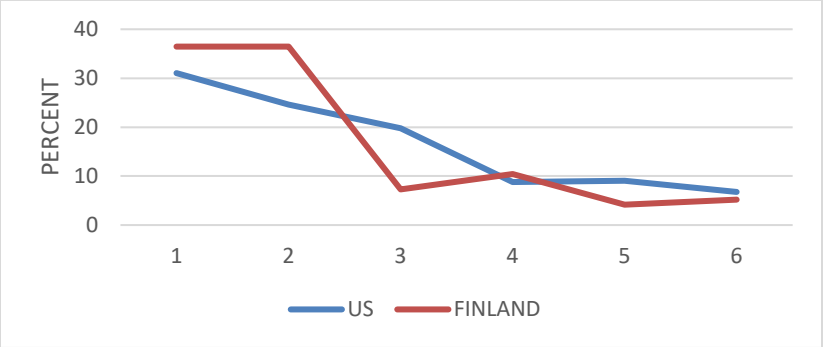


Figure 2: Relative frequency distribution tables. Variable = Phone Index (U.S. vs. other countries).







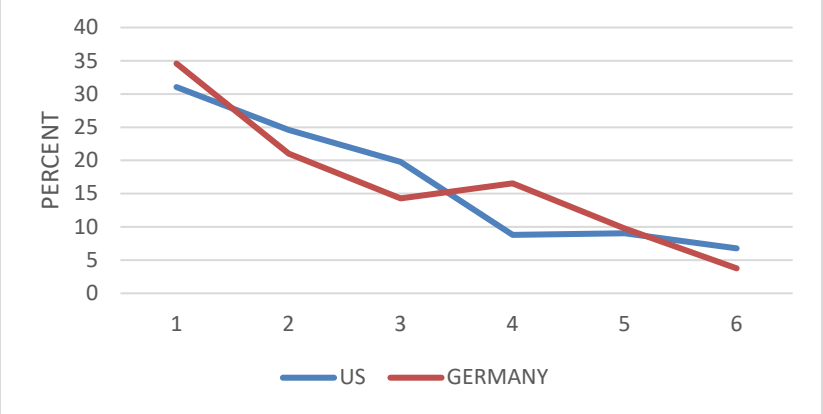
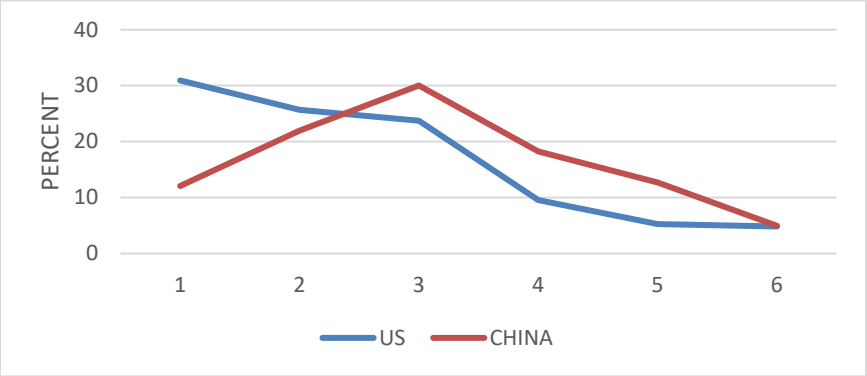
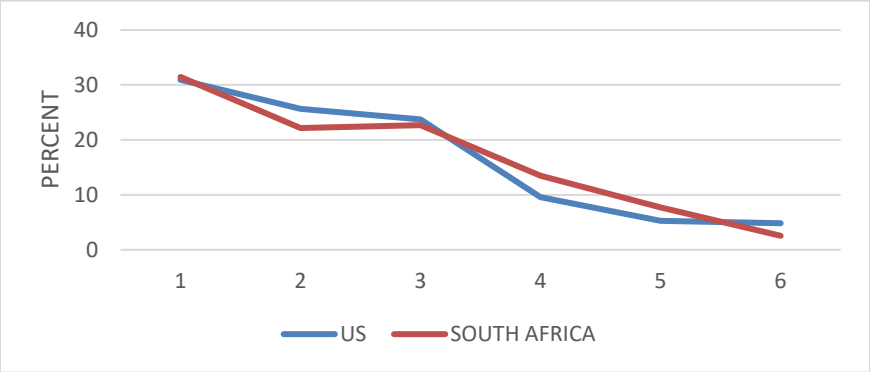
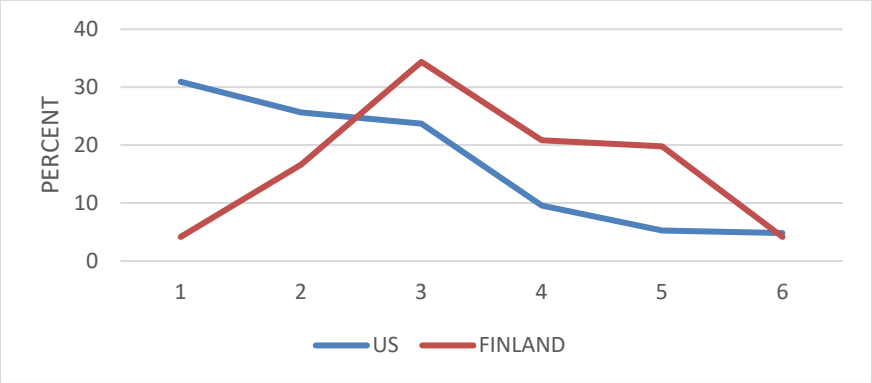


Figure 3: Relative frequency distribution tables. Variable = Anxiety Index (U.S. vs. other countries).







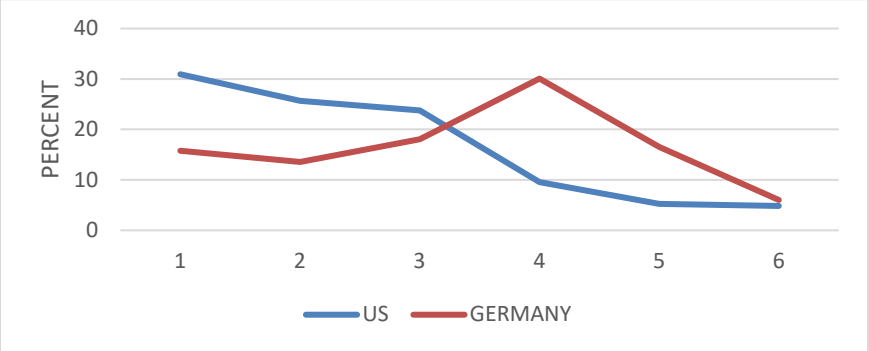


Table 1: Description of university samples and class policies.

	USA	China	Finland	Germany	South Africa
Brief description of universities	Mid-tier public university in northeast Ohio with approximately 13,000 students and a mid-tier public university in Florida with approximately 31,000 students	Top-tier public university in Beijing with approximately 15,000 students	Top-tier public university in central Finland with approximately 15,000 students	Mid-tier public university in Berlin with approximately 11,000 students	Top-tier public university in Pretoria with approximately 48,000 students
Description of surveyed class	Principles of Microeconomics and Principles of Macroeconomics	International Economy (equivalent to introductory economics)	Basics of Economics	Introductory Microeconomics	Introductory Economics
Number of instructors	5	1	1	8	8
Class format(s)	Face-to-face or lecture capture (students can attend live or watch online)	Face-to-face	Face-to-face	Face-to-face	Face-to-face (students not assigned to single instructor)
Number of exams per term	2 to 4 exams	3	1	1	2
Final exam weight on course average	20% to 30%	50%	100%	100%	50%
Type of exams	Multiple-choice, short answer, and graphical response	Multiple-choice, short answer, and graphical response	Multiple-choice only	Multiple choice, problem solving and short answer response	Multiple-choice, short answer, and graphical response
Ability to retake exams	Students were not able to retake exams except in extraordinary circumstances	If students failed the final exam (below 60%) they had to retake the course	A retake of the final exam was allowed upon student request within 12 months	A retake was allowed if the student failed the course	A retake was allowed if course average was 40 to 49% (50% is passing)
Campus life	Most students lived off campus and commuted more than 10 minutes	All students lived on campus	Most students lived on campus	No students lived on campus	Most students lived on campus

Table 2: Mindfulness measures: means and standard deviation by country.

Variable	United States (N=930)	South Africa (N=1502)	Germany (N=130)	Finland (N=96)	China (N=323)
I could be experiencing some emotion and not be conscious of it until some time later.	3.85 (1.34)	3.56 (1.39)	3.77 (1.22)	4.57 (1.32)	4.19 (1.28)
I break or spill things because of carelessness, not paying attention, or thinking of something else.	4.40 (1.36)	4.21 (1.51)	4.62 (1.21)	4.42 (1.38)	4.01 (1.30)
I find it difficult to stay focused on what's happening in the present.	3.94 (1.36)	3.88 (1.40)	4.03 (1.08)	3.94 (1.25)	3.90 (1.19)
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	3.38 (1.37)	3.22 (1.47)	3.41 (1.30)	3.46 (1.31)	3.31 (1.37)
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	4.09 (1.34)	4.04 (1.47)	4.21 (1.33)	4.38 (1.31)	4.50 (1.15)
I forget a person's name almost as soon as I've been told it for the first time.	3.26 (1.55)	3.28 (1.64)	3.23 (1.65)	2.90 (1.56)	3.52 (1.47)
It seems I am "running on automatic," without much awareness of what I'm doing.	3.88 (1.34)	3.86 (1.33)	3.59 (1.31)	4.11 (1.15)	4.36 (1.24)
I rush through activities without being really attentive to them.	3.88 (1.25)	3.83 (1.30)	4.11 (1.07)	4.13 (1.22)	4.05 (1.24)
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	3.61 (1.32)	3.68 (1.34)	4.25 (1.16)	4.15 (0.99)	4.07 (1.16)
I do jobs or tasks automatically, without being aware of what I'm doing.	3.86 (1.33)	4.14 (1.26)	4.00 (1.15)	4.14 (1.14)	4.20 (1.20)
I find myself listening to someone with one ear, doing something else at the same time.	3.29 (1.35)	3.48 (1.45)	3.83 (1.14)	3.10 (1.18)	3.31 (1.34)
I find myself preoccupied with the future or the past.	2.99 (1.39)	3.04 (1.39)	2.55 (1.26)	3.41 (1.38)	3.42 (1.32)
I find myself doing things without paying attention.	3.68 (1.32)	3.86 (1.32)	4.08 (1.03)	3.63 (1.06)	3.90 (1.24)
I snack without being aware that I'm eating.	4.57 (1.50)	4.58 (1.57)	4.65 (1.39)	4.99 (1.09)	5.18 (1.21)
ALL MAAS ITEMS	3.52 (0.75)	3.76 (0.78)	3.92 (0.63)	3.95 (0.64)	3.99 (0.66)
I find myself checking my phone or tablet during a typical class.	2.62 (1.55)	2.68 (1.49)	2.57 (1.52)	2.25 (1.42)	2.80 (1.36)
I feel anxious when taking exams.	2.48 (1.41)	2.52 (1.39)	3.34 (1.46)	3.49 (1.25)	3.12 (1.35)

*All questions answered according to Likert Scale where 1=Almost Always, 2=Very Frequently, 3=Somewhat Frequently, 4=Somewhat Infrequently 5=Very Infrequently and 6=Almost Never.

Table 3: Mindfulness measures: means by country and gender.

	United States		Finland		China		South Africa		Germany	
Variable	Female (n=449)	Male (n=473)	Female (n=41)	Male (n=53)	Female (n=226)	Male (n=96)	Female (n=820)	Male (n=676)	Female (n=79)	Male (n=51)
MAASQ1	3.71*	4.01*	4.51	4.63	4.14	4.29	3.42*	3.72*	3.75*	3.93*
MAASQ2	4.34	4.47	4.17	4.68	3.98	4.06	4.16	4.26	4.60*	5.10*
MAASQ3	3.83*	4.04*	3.72	4.29	3.89	3.91	3.89	3.87	4.02	4.13
MAASQ4	3.18*	3.57*	3.34	3.61	3.34	3.23	3.11*	3.37*	3.51	3.13
MAASQ5	4.19*	3.96*	4.45	4.24	4.49	4.51	4.09	3.99	4.29	4.16
MAASQ6	3.31	3.19	2.85	2.95	3.49	3.58	3.44*	3.08*	3.19	3.97
MAASQ7	3.76*	4.00*	4.00	4.22	4.42	4.22	3.82	3.91	3.80	3.80
MAASQ8	3.92	3.87	4.09	4.12	4.1	3.94	3.90*	3.75*	4.29	4.10
MAASQ9	3.61	3.60	4.13	4.17	4.12	3.96	3.75*	3.58*	4.29	4.14
MAASQ10	3.78	3.93	3.94	4.37	4.27	4.03	4.21*	4.07*	4.33	3.93
MAASQ11	3.13*	3.43*	2.98	3.29	3.34	3.26	3.39*	3.59*	3.88	3.93
MAASQ12	2.84*	3.14*	3.15*	3.73*	3.47	3.30	2.91*	3.19*	2.43	2.83
MAASQ13	3.59*	3.78*	3.38*	3.93*	3.90	3.90	3.86	3.85	4.29	4.15
MAASQ14	4.36*	4.77*	4.79*	5.24*	5.14	5.26	4.45*	4.73*	4.24*	4.86*
MAAS Index Mean	3.75*	3.91*	3.88*	4.16*	4.01	3.96	3.74	3.78	3.89	3.79
Phone Index	2.39*	2.82*	2.08	2.46	2.85	2.69	2.63	2.74	2.57	2.40
Anxiety Index	2.17*	2.78*	3.42	3.56	3.04	3.33	2.32*	2.76*	3.02*	3.80*

*Indicates the means between males and females are statistically different from one another at $p<.05$.

Note: The sum of male and female students in each country sample does not equal the total number of students as some students chose not to report their gender.

Table 4: MAAS, Phone, and Anxiety averages by performance quintiles.

	Relative Final Average				Relative Final Exam		
China	MAAS Avg	Phone	Anxiety		MAAS Avg	Phone	Anxiety
Top Quintile	4.10	3.03	2.92		4.04	2.29	3.28
2nd Quintile	3.93	2.42	3.05		3.92	2.72	2.72
3rd Quintile	3.98	2.89	3.32		3.95	2.89	3.12
4th Quintile	4.00	2.88	3.02		4.05	3.06	3.23
Bottom Quintile	3.96	2.78	3.32		4.01	3.03	3.27
Correlation Coeff.	.086	-.010	-.081		.010	-.160*	-.060
Finland	MAAS Avg	Phone	Anxiety		MAAS Avg	Phone	Anxiety
Top Quintile	4.19	2.16	3.89		4.19	2.16	3.89
2nd Quintile	4.10	2.32	3.42		4.10	2.32	3.42
3rd Quintile	3.80	2.21	3.32		3.80	2.21	3.32
4th Quintile	4.19	2.63	3.74		4.19	2.63	3.74
Bottom Quintile	3.50	1.95	3.10		3.50	1.95	3.10
Correlation Coeff.	.167	.079	.144		.167	.079	.144
Germany	MAAS Avg	Phone	Anxiety		MAAS Avg	Phone	Anxiety
Top Quintile	3.79	2.33	3.47		3.79	2.33	3.47
2nd Quintile	3.39	1.80	3.13		3.39	1.80	3.13
3rd Quintile	4.20	3.27	3.40		4.20	3.27	3.40
4th Quintile	3.87	2.58	4.25		3.87	2.58	4.25
Bottom Quintile	3.87	2.53	2.67		3.87	2.53	2.67
Correlation Coeff.	-.065	-.036	.192		-.065	-.036	.192
South Africa	MAAS Avg	Phone	Anxiety		MAAS Avg	Phone	Anxiety
Top Quintile	3.85	2.88	2.61		3.79	2.78	2.61
2nd Quintile	3.84	2.68	2.61		3.83	2.74	2.62
3rd Quintile	3.73	2.63	2.54		3.73	2.59	2.55
4th Quintile	3.74	2.51	2.45		3.75	2.67	2.44
Bottom Quintile	3.65	2.70	2.36		3.69	2.62	2.35
Correlation Coeff.	.100*	.058*	.085*		.058*	.029	.070*
United States	MAAS Avg	Phone	Anxiety		MAAS Avg	Phone	Anxiety
Top Quintile	3.58	2.92	2.90		3.51	2.82	2.85
2nd Quintile	3.54	2.81	2.66		3.59	2.83	2.74
3rd Quintile	3.56	2.66	2.46		3.51	2.62	2.41
4th Quintile	3.48	2.32	2.24		3.51	2.45	2.25
Bottom Quintile	3.45	2.37	2.14		3.48	2.35	2.14
Correlation Coeff.	.075*	.144*	.194*		.025	.120*	.189*

Note: Correlation Coeff measures Pearson's correlation coefficient between the variable and relative performance.
*p<0.05

Table 5: Pearson correlation coefficients between MAAS, Phone, and Anxiety indexes.

ALL (N=2981)	MAAS Index	Phone Index	Anxiety Index
MAAS Index	1		
Phone Index	0.263*	1	
Anxiety Index	0.323*	0.171*	1
China (N=323)	MAAS Index	Phone Index	Anxiety Index
MAAS Index	1		
Phone Index	0.241*	1	
Anxiety Index	0.269*	0.199*	1
Finland (N=96)	MAAS Index	Phone Index	Anxiety Index
MAAS Index	1		
Phone Index	0.185	1	
Anxiety Index	0.341*	0.085	1
Germany (N=130)	MAAS Index	Phone Index	Anxiety Index
MAAS Index	1		
Phone Index	0.230*	1	
Anxiety Index	0.154	-0.018	1
South Africa (N=1502)	MAAS Index	Phone Index	Anxiety Index
MAAS Index	1		
Phone Index	0.307*	1	
Anxiety Index	0.306*	0.185*	1
United States (N=930)	MAAS Index	Phone Index	Anxiety Index
MAAS Index	1		
Phone Index	0.230*	1	
Anxiety Index	0.329*	0.195*	1

*$p<0.05$

Table 6: Variable definitions means and standard deviation by country.

Variable	Definition	China (N=323)	Finland (N=96)	Germany (N=130)	South Africa (N=1502)	United States (N=930)
Relative Final Average	(Student final average – class mean) / class mean	0.000 (0.11)	-0.049 (0.26)	0.003 (0.50)	0.000 (0.19)	0.012 (0.13)
MAAS Index	Mean of answers to 15 MAAS items.	3.99 (0.66)	3.95 (0.64)	3.92 (0.63)	3.76 (0.78)	3.52 (0.75)
Phone Index	I find myself checking my phone or tablet during a typical class.	2.80 (1.36)	2.25 (1.42)	2.57 (1.52)	2.68 (1.49)	2.62 (1.55)
Anxiety Index	I feel anxious when taking exams.	3.12 (1.35)	3.49 (1.25)	3.34 (1.46)	2.52 (1.39)	2.48 (1.41)
Socialmedia	=1 if uses social media 10 or more times per day	0.74 (0.44)	0.55 (0.50)	0.55 (0.50)	0.34 (0.47)	0.42 (0.49)
Face-to-Face	=1 if prefers face-to-face classes	0.60 (0.49)	0.38 (0.49)	0.43 (0.50)	0.46 (0.50)	0.53 (0.50)
Nclasses	Number of classes student is enrolled in	8.93 (2.20)	5.61 (0.94)	5.86 (0.37)	5.43 (0.92)	3.90 (1.29)
Freshman	=1 if class standing is freshman	0.53 (0.50)	0.47 (0.50)	0.38 (0.49)	0.91 (0.28)	0.14 (0.35)
Sophomore	=1 if class standing is sophomore	0.19 (0.39)	0.22 (0.42)	0.06 (0.24)	0.07 (0.26)	0.45 (0.50)
Junior	=1 if class standing is junior	0.20 (0.40)	0.06 (0.24)	0.02 (0.15)	0.01 (0.12)	0.29 (0.45)
Male	=1 if male	0.30 (0.46)	0.55 (0.50)	0.39 (0.49)	0.45 (0.50)	0.51 (0.50)
Married	=1 if married or partnered	N/A	0.48 (0.50)	0.35 (0.48)	0.09 (0.28)	0.12 (0.33)
Child	=1 if taking care of a child	N/A	0.04 (0.54)	0.02 (0.15)	0.02 (0.15)	0.06 (0.23)
Black	=1 if black	N/A	N/A	0.02 (0.15)	0.40 (0.49)	0.14 (0.35)
Age19_less	=1 if age 19 or less	0.54 (0.50)	0.10 (0.31)	0.34 (0.48)	0.73 (0.45)	0.38 (0.49)
Distance0_10	=1 if lives on campus or commutes 10 minutes or less to campus	N/A	0.86 (0.34)	0.53 (0.50)	0.65 (0.48)	0.22 (0.41)
NoWork	=1 if not employed	N/A	0.76 (0.43)	0.42 (0.50)	0.76 (0.43)	0.26 (0.44)
Work1_20	=1 if works between 1-20 hours per week	N/A	0.21 (0.41)	0.32 (0.47)	0.21 (0.41)	0.31 (0.46)

Table 7: OLS estimates of mindfulness, all countries; dependent variable = Final Average.

	All Countries (N=2956)	China (N=320)	Finland (N=96)	Germany (N=129)	South Africa (N=1485)	United States (N=926)
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
MAAS Index	0.039*	0.085	0.226**	-0.038	0.073***	0.019
Phone Index	0.030	-0.052	0.013	0.016	0.009	0.098***
Anxiety Index	0.062***	-0.079	-0.014	0.050	0.067**	0.154***
Socialmedia	-0.063***	0.015	-0.262**	-0.247***	-0.059***	0.026
Face-to-Face	0.018	-0.013	0.205**	0.127	0.016	-0.057*
Nclasses	-0.038	-0.076	0.206**	-0.043	-0.072***	0.025
Freshman	0.044	-0.143	0.334***	0.016	0.116	-0.051
Sophomore	-0.019	-0.083	-0.081	-0.029	0.030	-0.091*
Junior	-0.019	-0.132	0.119	-0.028	-0.010	-0.042
Male	-0.068***	-0.223***	0.091	-0.184**	-0.064**	0.001
Married	-0.012	n/a	0.278***	-0.127	-0.001	0.012
Child	0.015	n/a	0.081	-0.091	0.056**	-0.024
Black	-0.070***	n/a	n/a	0.164*	-0.048*	-0.206***
Age19_less	0.025	0.045	-0.110	-0.113	-0.009	0.142***
Distance0_10	0.056***	n/a	0.057	0.122	0.046*	-0.037
NoWork	0.166***	n/a	-0.158	0.066	0.177***	0.165***
Work1_20	0.041	n/a	-0.224	-0.100	0.081	0.104***
R-squared	0.044	0.081	0.320	0.190	0.052	0.154

Note: Final Average is measured as standard deviations from the mean.
Country fixed effects included in the combined sample.
Coefficients are significant at *10%; **5%; ***1%.

APPENDIX. Questionnaire

1. **Consent Statement:** The purpose of this research study is to assess the factors related to academic learning, and to compare the results to other classes. Please read the attached Consent Form, which describes the purpose of this questionnaire and how the information collected will be used. To continue with the questionnaire, you acknowledge that you read the Consent Form and understand its terms. Participation in this study is voluntary and you may opt out at any time.

2. During a typical day, how often do you use social media such as Instagram, Facebook, or Twitter?

___ More than 10 times per day ___ 2 – 3 times per day ___ I don't use social media
___ 6 – 9 times per day ___ Once a day ___ No answer
___ 4 – 5 times per day ___ Almost never

3. When selecting a course, do you generally prefer a purely online, hybrid (part online and part face-to-face), or a face-to-face class?

___ I generally prefer purely online classes ___ I generally prefer face-to-face classes
___ I generally prefer hybrid classes ___ I do not have a preference

4. For each of the following statements, indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item. Your choices are: Almost Always (1), Very Frequently (2), Somewhat Frequently (3), Somewhat Infrequently (4), Very Infrequently (5), Almost Never (6), or have no answer (NA).

	1	2	3	4	5	6	NA
I could be experiencing some emotion and not be conscious of it until some time later.							
I break or spill things because of carelessness, not paying attention, or thinking of something else.							
I find it difficult to stay focused on what's happening in the present.							
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.							
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.							
I forget a person's name almost as soon as I've been told it for the first time.							
It seems I am "running on automatic," without much awareness of what I'm doing.							
I rush through activities without being really attentive to them.							
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.							
I do jobs or tasks automatically, without being aware of what I'm doing.							
I find myself listening to someone with one ear, doing something else at the same time.							
I drive places on 'automatic pilot' and then wonder why I went there.							
I find myself preoccupied with the future or the past.							
I find myself doing things without paying attention.							
I snack without being aware of what I'm eating.							
I find myself checking my phone or tablet during a typical class.							
I feel anxious when taking exams.							

5. How much knowledge do you have of the concept of mindfulness?

___ I have a lot of knowledge of the concept. ___ No answer
___ I have heard of the concept but do not know much about it.
___ I may have heard about this concept but not sure.
___ I have not heard about this concept before.

6. Do you have experience with meditation?
___ I practice meditation every day or almost every day. ___ I have never practiced meditation.
___ I practice meditation a few times per week in a typical week. ___ No answer
___ I practice meditation once in a while.
___ I have practiced meditation in the past but seldom do now.

7. What is your current major (if undeclared, what do you plan to major)? _____ ___ No answer

8. Is this course required for your major or anticipated major? ___ Yes ___ No ___ No answer

9. Have you taken a college-level Microeconomic or Macroeconomic principles course in a previous semester? ___ No ___ Yes ___ No, but passed AP exam ___ No answer

10. Including this class, how many classes are you taking this semester (including any dropped classes)?
___ 1 ___ 2 ___ 3 ___4 ___ 5 ___ More than 5 ___ No answer

11. What is your current class standing? ___ Freshman ___ Sophomore ___ Junior ___ Senior
___ Graduate Student ___ Non-degree seeking ___No answer

12. What is your current approximate overall GPA? ___ 0.00 to 1.00 ___ 1.01 to 1.50 ___ 1.51 to 2.00
___ 2.01 to 2.50 ___ 2.51 to 2.75 ___ 2.76 to 3.00 ___ 3.01 to 3.25 ___ 3.26 to 3.50
___ 3.51 to 3.75 ___ 3.76 and higher ___ I currently do not have a GPA ___ no answer

13. What is your gender? ___ Female ___ Male ___ No answer

14. What is your age? ___19 or younger ___ 20-21 ___ 22-23 ___ 24-25
___ 26-30 ___ 31-40 ___ Over 40 ___ No answer

15. Do you have a child at home who you take care of? ___ Yes ___ No ___ No answer

16. Are you currently married or partnered? ___ Yes ___ No ___ No answer

17. Are you of Hispanic, Latino, or Spanish origin? ___ Yes ___ No ___ No answer

18. What is your race? ___ Black ___ White ___ Asian ___ Native American
___ Mixed ___ Other ___ No answer

19. Do you live in a residence hall on campus? ___ Yes ___ No ___ No answer

20. How far do you live from campus? ___ 0 (I live on campus) ___ less than 5 miles ___ 6-10 miles
___11-15 miles ___16-20 miles ___ 21-25 miles ___ 26-30 miles
___ 31-40 miles ___ over 40 miles ___ No answer

21. How long does it take, one-way, for you to commute to campus (not including time searching for parking)? ___ 0 (I live on campus) ___ less than 10 min ___ 11-20 min ___21-30 min
___31-40 min ___ 41-50 min ___ 51-60 min ___over 60 min ___ No answer

22. About how many hours a week do you work at a job this semester, on average?
___ 0 (I am not working this semester) ___ 1–5 ___ 6-10 ___ 11-15 ___ 16-20
___ 21-25 ___ 26-30 ___ 31-35 ___ 36-40 ___ 40+ ___ No answer

23. Do you receive any need-based financial aid? __ Yes ___ No ___ No answer

24. Is English your native language? ___ Yes ___ No ___ No answer