The explanatory determinants of a successful mindfulness intervention in an ecuadorian university: a logit analysis

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ABSTRACT
This paper examines the success of a Mindfulness Intervention on 206 freshmen at the School of Social Sciences and Humanities of ESPOL, in Guayaquil-Ecuador by using logit analysis. The results show that age, gender, type of college, college’s location, number of mindfulness sessions, admission score, approved subjects, academic scores, people you live with, birth order, higher education career, play musical instrument, practice sport, and the use of glasses of the respondents have significant effects on mindfulness practice. The contribution of the study remains as the observed effects might respond to a particular behavior of students of social sciences. A future approach may then include students from different areas and analyze if there are any differences among such groups.

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Introduction
Mindfulness is defined as the capacity of full perception and awareness of what is taking place around us (Brown, Ryan, & Creswell, 2007). Its development has been considered as an alternative to help stabilize individuals’ physical and mental processes, given that this meditation practice allows each to enjoy each experience to which he is exposed (Roeser & Peck, 2009), (Roeser & Peck, 2009). The mindfulness practice has become more popular since the seventies, and there have been several studies trying to measure its effectiveness as a tool to balance emotions and behavior (Krafft, Haeger, & Levin, 2017).

Some experiments have searched for physical effects and others for academic improvement (Almirall, Kasari, McCaffrey, & Nahum-Shani, 2017; Bunce, Baird, & Jones, 2016; Caro, 2015; Levin & Belfield, 2015) knowing that presence of stress hinders the appropriate students’ performance (Craddock & Mathias, 2009; Denovan, Dagnall, Dingra, & Grogan, 2017). García Campayo (2008) showed that a Mindfulness-Based Stress Reduction program (MBSR) helped patients and professionals with conditions such as stress levels, depression, cancer, addiction, pain, generalized anxiety, arthritis, and fibromyalgia. Similarly, Hölzel et al. (2011) presented a controlled longitudinal study to investigate about changes in the brain through observations during the pre- and post-intervention phases. They used a magnetic resonance test, and the FFMQ test with 16 participants was asked to meditate for eight weeks and received a 45-minute audio guide to mindfulness exercises. The results showed that there an increase in the concentration of grey matter on the left hippocampus, suggesting that its practice can improve learning and memory, emotion regulation, self-processing referential and perspective taking. The literature about the effects mindfulness practice on health-related subjects is extensive, for example, Manotas, Segura, Eraso, Oggins, and
McGovern (2014) demonstrated the impact of mindfulness practice could reduce affections or ailments, Vinci et al. (2014) showed that mindfulness practice could reduce the desire of drinking alcohol, while Caldwell, Harrison, Adams, Quin, and Greeson (2010) even found that mindfulness practice could have effects on sleep quality.

Our literature review shows a set of previous works that analyze the effect of mindfulness practice in different environments with an emphasis in higher education and the mindfulness assessment tests that we use in our analysis, to justify the construction of our experimental design. This work seeks to contribute to the literature on mindfulness interventions in higher education by analyzing the marginal impact produced by a set of sociodemographic variables and characteristics of individuals in improving mindfulness level, with particular attention to the minimal effect that creates the fulfillment of the totality our mindfulness sessions program. Because assessments can help identify and evaluate strengths and weaknesses, grade student learning, monitor and provide feedback on student progress, assess competence and help predict future behavior (Clements & Cord, 2013), our approach allows us to consider a set of variables that can let a mindfulness assessment to be successful.

For this purpose, we use a representative sample of 206 students from social sciences divided into two groups which were designed to allow the significant variability for our marginal analysis. Through the logit approach, these variables were determined because we consider it essential to know why in a set of individuals the application of a mindfulness program can have a positive effect or not.

The following sections of the paper are distributed as follows: Section 2 provides a literature review concerning mindfulness practice in the education and measurement scales used in our study. Section 3 describes the methodology used for the realization of our logit approach. Section 4 details our empirical results while Section 5 shows the conclusions.

**Review of literature**

The analysis must start from the existing literature on mindfulness practice in education. Previous research has found that university students experience higher levels of psychological distress than the general population (Stallman, 2008, 2011, 2012). It is especially true among freshmen (Liu & Chang, 2014), as they need to get used to the new system, relate to new people, and face heavier study workload. In the field of higher education students is no different, because starting at higher education could mean students are moving to new and bigger cities, culturally diverse, and usually unknown to them. The positive effect of mindfulness practice on higher education students of allows the application of our analysis in this field. Several universities have already incorporated it to help students deal with stress and pressure that are common to the educational environment (Moniz & Slutzky, 2016).

Some examples show that mindfulness practice is useful, in the case of Felver, Frank, and McEachern (2014) that compared the acute effects of participating in a single yoga class versus a single standard physical education (PE) class on the mood of the student. With a sample of forty-seven high school students they assessed the effect before, and after participating in a single yoga class and a single PE class one week later. The authors reported that the participants had significant decreases in anger, depression, and fatigue from before to after participating in yoga compared to PE. They suggest that school-based yoga may provide unique benefits for students above and beyond participation in PE. Likewise, Schonert-Reichl and Lawlor (2010) assessed the effectiveness of a mindfulness education program in the development of social and emotional competencies. 246 adolescent students received daily training in conscious attention. Students in the program showed a significant increase in their optimism levels compared to those who did not receive any training.

The literature is extensive referring to the different measurement scales of mindfulness practice. One of the most commonly used questionnaires to measure mindfulness is the Five Facets of Mindfulness Questionnaire (FFMQ, Baer et al., 2008). This questionnaire measures five mindfulness
skills, i.e. observe, describe, act with awareness, non-reactivity, and non-judgment, that can be combined into a total score of mindfulness (López, Sanderman, & Schroevs, 2016). The FFMQ has been tested in meditation and student samples and has shown excellent psychometric properties. The FFMQ has criticisms about its measurement, but its use is widely accepted. For example, Inchausti, Prieto, and Delgado (2014) investigated the difference in the FFMQ scores between meditators and non-meditators using a sample of 263 undergraduates. They found that experienced meditators received higher scores on the FFMQ than nonmeditators. Related to this, Regehr, Glancy, and Pitts (2013) examined the perceived benefits of participants in a continuous meditation study. They followed up weekly reports of 65 undergraduate students who practiced meditation throughout the semester and found evidence of cognitive, emotional and spiritual benefits.

Brown and Ryan (2003) developed the Mindful Attention Awareness Scale (MAAS), which is a promising self-report measure of mindfulness that purports to measure a conceptualization of mindfulness as ‘the presence or absence of attention to and awareness of, what is occurring in the present moment.’ The MAAS was examined in series of studies that indicated strong psychometric properties (Jermann et al., 2009) and demonstrated that scores on the MAAS improved over time during an 8-week standardized mindfulness-based stress reduction program (Inchausti et al., 2014). Lilja, Lundh, Josefsson, and Falkenström (2013) interpreted the MAAS as a valid measure of mindfulness but suggesting that novice-level experience with meditation should not be presumed to be associated with higher mindfulness. Given the properties of the FFMQ and MAAS tests, we applied these tests and used their results as measures to evaluate possible improvements in mindfulness level. It is important to mention that the FFMQ was constructed by combining various mindfulness questionnaires, including the MAAS. In fact, the facet of awareness in the FFMQ consists exclusively of MAAS items. We employ both of these instruments with the aim of achieving consistency in the obtained results.

**Methods**

**Participants**

From our perspective, higher education can become an integral training space where students, besides to receive technical training in the area of specialization chosen, to develop positive habits for their personal development. Therefore, in the search for that crucial element of contribution for its development, mindfulness practice was selected as a subject of study and application within the School of Social Sciences and Humanities of ESPOL classrooms.

The sample comprised a select group of students enrolled in the mindfulness class in the first semester 2014 at the School of Social Sciences and Humanities of ESPOL, located in Guayaquil, Ecuador. The treatment is a comprehensive intervention that focuses on getting students can improve through the mindfulness practice. Initially 303 students were enrolled in the different courses offered; however, the dropout margins due to the student’s time load reduced the sample to 206 students, which we consider appropriate observations for the realization of our estimates.

**Procedure**

If before and after the mindfulness sessions, there is an improvement measured through the FFMQ and MAAS tests or not is our event of interest to design our dependent variable.

The guided-mindfulness meditation class group received mindfulness and yoga classes with a credited instructor for eleven weeks. Students could choose three out of ten schedule alternatives per week. The students were notified through online and printed personalized letters, as well as significant advertisements and publications. Then, they participated in a two-hour meeting to take the pre-treatment tests and to receive the group-specific instructions, as follows:
Group A:
(1) Attendance to a minimum of three Mindfulness-Yoga sessions per week, being able to choose between ten different schedules.
(2) Structure of courses: 10 minutes to monitor the presence and 50 minutes of active class: 30 minutes in movement, 10 minutes in relaxation and 10 minutes of meditation.
(3) Arrival: 15 minutes before the starting time and wearing comfortable clothes.

Group B:
(1) Attendance: exercises should be performed at least six days per week, at any time of the day. The program generated a personalized record card to control the number of completed sessions.
(2) Structure of sessions: Each one lasted between 5 and 20 minutes. Students were allowed to execute at most one session per day.

In the period of application of the FFMQ and MAAS tests – pre and post treatment-the students’ demographic information and a set of additional measurements were also requested. Specifically, we collected data on whether these sets of students used glasses, weight, if they practice reading, if they practice sports, the number of people with whom they live, if they play a musical instrument, which contributed to the formulation of our approach to determinants of the success of mindfulness practice.

Measure
As mentioned above, the dependent variable was defined as follows: ‘1’ if the individual improved in mindfulness practice measured through the FFMQ and MAAS test; ‘2’ if the individual did not improve in mindfulness practice measured through the FFMQ and MAAS test, both considering the tests results in the surveys before and after intervention. The development of the tests was in Spanish, considering that Purser, Forbes, and Burke (2016) assessed the psychometric properties of the MAAS in Spanish version using a sample of 385 individuals aged between 18 and 63 years old. Such sample included 201 individuals with a medical history and 184 college students. The results confirmed the reliability and validity of that version of the MAAS, which supports the instrument’s global homogeneity, as in its original version. Table 1 shows the set of variables considered in this analysis, which could be possible determinants of the success of practicing mindfulness.

Our sample shows that we have a more significant number of male gender participants (77.67%) from this, we have a higher concentration of respondents older than 19 years, which is a definite, descriptive point of a higher education students group. We have a higher number of students living in the city of Guayaquil (76.21%). We also have a higher percentage of students excelled in all classes that they took in the time that duration of the experiment, which is supported with the fact that there are more students with high academic scores. Mostly we have students who are the first son of their respective families, and our sample does not predominate the group of students who use glasses.

Statistical analysis
Table 2 shows the descriptive statistics of the variables used in the logit model. The set of possible determining factors for improvement in mindfulness in higher education students’ context were determined by using regression analysis. The dependent variable was in dichotomous (dummy) form; hence, in this case, a binary logistic model is the most appropriate econometric tool for analysis (Greene & Hill, 2010). The specification of our model and description of maximum likelihood procedure is detailed in Appendix 1.
Empirical results and discussion

After that, the maximum likelihood procedure was used to estimate the coefficients of the logit analysis of the factors determining the success of mindfulness practice. Our results confirmed that the variables such as: age, gender, type of college, college’s city (location), number of sessions, admission score, approved subjects, academic score, people you live with, birth order and glasses use, had significant effects on the success of a mindfulness practice, as is shown in Tables 3 and 4.

As expected, variables such as ‘practice sports,’ ‘practice reading,’ ‘play a musical instrument’ were statistically significant, and the fact that they practice such practices increases the probability that a student will improve in mindfulness. Our sample specifies that economics students are less likely to succeed in mindfulness practice than students of international business engineering and commercial engineering, this finding may be subject to such students being subject to more analytical approaches, which complicates their understanding and delay their learning and causes greater stress amounts.

The FFMQ regression results show that, as compared to the mindfulness practice less than ten sessions (base category), the mindfulness practice over ten sessions had a significant effect on the success of mindfulness practice. More specifically, the odds ratios of 0.146593, 0.310068 and 1.072419 indicate that the probability of a mindfulness practice success concerning the mindfulness practice over ten sessions is 14.66%, 31.01% and 107.24% respectively, upper as compared to the base category of the mindfulness practice less than ten sessions. The MAAS regression results also show that mindfulness practice over ten sessions had a significant effect on the success of mindfulness practice. The odds ratios of 0.698031, 0.865068 and 0.924296 indicate that the probability of a mindfulness practice success concerning the mindfulness practice over ten sessions is 69.80%, 86.51%, and 92.43% respectively, upper as compared to the base category of the mindfulness practice less than ten sessions. These particular results are not consistent with previous studies because the existing literature focuses on the effect of a complete program of mindfulness practice, while the marginal impact of having one more practice session has not been calculated.

FFMQ and MAAS estimates are consistently demonstrating that students are more likely to succeed in practice mindfulness as their age increases. As a result, female students are less likely to be successful in practicing mindfulness in comparison to male students with approximately 33.49% (on average). This finding is partially consistent within the study of (Lavender, Jardin, & Anderson, 2009).

### Table 1. Explanatory variables categorization.

| Variable                  | Number and specification of categorization |
|---------------------------|--------------------------------------------|
| Age                       | From 17 to 19 years | From 20 to 27 years |
| Gender                    | Male | Female |
| Type of College           | Private | Fiscal |
| College’s City            | Guayaquil | Others |
| Number of Sessions        | Less than ten sessions | From 11 to 20 sessions | From 21 to 30 sessions | More than 30 sessions |
| Admission Score           | From 7.00 to 7.99 | From 8.00 to 8.99 | From 9.00 to 10.00 |
| Approved subjects         | All | Not all |
| Academic score            | Yes | No |
| People you live with      | None | Partners | Parents | Relatives |
| Birth order               | Only son | First son | Middle son | Last son |
| Glasses Use               | Yes | No |
| Career                    | Economics | International Business engineering | Commercial engineering |
| Play sports               | Yes | No |
| Lecture                   | Yes | No |
| Play musical instrument   | Yes | No |
| Group                     | A | B |

Note: The numbers 1–4 express how the variables were codified for information collection and estimation purposes.
that analyzed how to reduce the symptoms of bulimia performed the comparison on a men’s sample (N = 219) and a women’s sample (N = 187), determining that the effect of practice mindfulness is higher in men who reported higher margins of suppression of eating disorders through a hierarchical regression analysis.

Limitations and future research

The present study had several limitations. First, the sample was composed of higher education students, so the results may not be generalized to other adult or students’ populations. Future research should seek to validate the logit approach in a general adult population and different students’ populations. Second, while the present results suggest that higher education students’ impact could be similar to the mindfulness sessions, it is not clear whether populations comprehend the concept of mindfulness similarly or just performed the test as a class that was fashionable in ESPOL. Because attendance at sessions was a matter of student motivation, we could
compromise the net effect of attending a session because some students went when they felt motivated by peers or when they felt like participating. Hence, a design should be made in which programs are divided that last specifically one, two or more weeks specifically. Finally, the present research scarcely began to test the validity of demographic variables for improving mindfulness level, and future research will need to test the application of this approach for valued experiential, neurological, and behavioral outcomes.

**Conclusion**

This project started with the objective of executing an innovative experiment within ESPOL and that can be replicated in other universities in Ecuador. Our motivation was based on international
studies that show that mindfulness is a beneficial intervention for higher education students, through the improvement of concentration levels and academic performance.

As exposed, the city and school considered for the study constitute a particularly interesting scenario for the analysis of determinants of success of a mindfulness intervention in educational contexts. The application of the intervention discussed in this paper focused on proving that demographic variables, number of sessions, admission score, approved subjects, academic scores, people you live with, birth order and the use of glasses have significant effects on the success of mindfulness practice.

Despite the existence of several applications on the effects of mindfulness practice in different fields (Caldwell et al., 2010; Grandpierre, 2013; Kuyken et al., 2013; Lilja et al., 2013; Song & Lindquist, 2015; Thompson & Waltz, 2007), there are no previous studies in which the success of training mindfulness is

| Table 4. Logit estimates of MAAS. |
|---|---|---|---|
| Variable | Categories | Coefficient | Standard Error | Odds Ratio |
| Group | (Group A) Group B | 1,358,794*** | 0.2738325 | 0.2669705 |
| Age | (17–19) 20–27 | 0.3339827*** | 0.383114 | 1.396519 |
| Sex | (Male) Female | −0.5935612* | 0.1585052 | 1.165351 |
| Type of College | (Private) Fiscal | 0.4758192*** | 0.1452083 | 1.609332 |
| College’s City | (Guayaquil) Others | −0.8201349** | 0.3469682 | 0.4403722 |
| Number of Sessions | (Less than 10) 11–20 21–30 More than 30 | 0.1449477*** 0.5294691* 0.6545603*** | 0.0495865 0.1203815 0.1080237 | 0.698031 0.865068 0.924296 |
| Career | (Economics) International Business Engineering Commercial Engineering | 0.042491** 0.1196512*** | 0.0159193 0.0120545 | 2.836273 0.887229 |
| Admission Score | (7.00–7.99) 8.00–8.99 9.00–10.00 | −1,426,277 *** −0.8707772** | 0.0197934 0.1036177 | 0.2402016 0.4186261 |
| Approved subjects | (All) Not all | −0.5158246*** | 0.1410536 | 0.5970081 |
| Academic score | (Yes) No | −0.0852428*** | 0.0078508 | 1.088981 |
| People you live with | (None) Partners Parents Relatives | −2,649,404*** 0.8667561*** 0.872191* | 0.0907804 0.2239915 0.1642411 | 1.659682 12.76063 15.76944 |
| Birth order | (Only son) First son Middle son Last son | −0.3441632*** 0.4013772*** 0.5923375*** | 0.0241478 0.0857191 0.0616898 | 0.7087991 1.80821 0.6693975 |
| Practice Sport | (Yes) No | −0.1215422*** | 0.0107874 | 0.855537 |
| Play Musical Instrument | (Yes) No | −0.0269245** | 0.0081001 | 0.9734347 |
| Glasses Use | (Yes) No | −0.5812154*** | 0.0008048 | 1.788211 |
| Reading | (Yes) No | −0.0156109** | 0.0081001 | 0.9845103 |
| Intercept | 206 | −0.093508*** | 0.0022318 | 0.9107307 |

Base categories are in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1. Robust standard errors used.
determined from a set of demographic characteristics as well as the margin of attendance to a set of sessions as determinants of such success, goal which plans to fulfill this research.

This study tried to fill the void in the existing literature, proposing a model in which it is determined the set of variables that can influence the success of a mindfulness practice; however, the next step should focus on the inclusion of a heterogeneous group, which can provide essential characteristics to determine the possible success of an intervention.

The contribution of the study remains as the observed effects might respond to a particular behavior of students of social sciences. A better approach may then include students from different areas especially like applied sciences and different levels, and analyze if there are any differences among such groups, according to Gordon, Reid, and Petocz (2010) that emphasize the importance of the diversity of higher education classes.

Notes

1. For example, Van Dam, Earleywine, and Danoff-Burg (2009) proved that mindfulness practice has a positive impact on students’ educational outcomes with an online sample of meditators and non-meditators -undergraduates at a state university in the northeastern United States- with similar overall levels of mindfulness. Also, Orsmond & Merry, (2013) indicate that Mindfulness adds many essential dimensions particularly concerning the way students approach new learning situations.

2. According to Gauswinkler and Unterrainer (2016), Yoga is an ancient practice rooted in India. The primary focus of yoga is essential to arrive in the ‘here and now’ – by focusing on the present moment, similar to mindful meditation techniques. As a result, mindfulness is trained on one’s feelings, thoughts, body, and environment. López et al. (2016) mention that although there is a vast amount of different schools of yoga, it can be concluded that the most common yoga styles include physical postures, control of breath and the use of meditation to increase strength, flexibility, and mindfulness.

3. Although definitions of mindfulness abound and may vary across settings and disciplines, a common theme across all of the extent definitions is that mindfulness is a way of directing attention. We understand the relationship between conscious awareness and mindfulness according to Segal, Williams, and Teasdale (2007). It means that mindfulness is considered to be a state of consciousness that incorporates self-awareness and attention.

4. Testing effects was considered since participants were receiving the same measures before and after each intervention session.

5. We believe that from this sample we can make inferences about characteristics of the whole population, that is to say, that conclusions can be obtained that are valid for the community as a whole, the representativeness of the sample is determined because it is precisely the total of affected individuals by the intervention.

6. Specifically, there were ten daily schedules – from Monday to Friday – where the students could attend the practice, of which each student was allowed to participate in 3 times whose time could be chosen by the student.

7. We performed this division of groups to allow our sample to have variability in the number of sessions attended by each student because in our logistic design would be an independent categorical variable the information provided by these groups.

8. When coding the dependent variable of our model – which had the ultimate goal of determining the probability of an individual improving in his mindfulness level – we decided to codify as ‘improvement in the mindfulness level’ the fact that a student improves his final assessment in the FFMQ test, if in the post-treatment survey the student exceeded his initial assessment in the FFMQ test and was coded with the number 1 -for estimation purposes in statistical software- otherwise it was coded as 2. The same reasoning was used for the pre- and post-treatment assessment of the MAAS test.

9. For example, Napoli, Krech, and Holley (2005) used trainers, and research assistants within two elementary schools in a U.S. Southwestern city to conduct mindfulness sessions and they showed how a participation in a mindfulness training program affected first, second, and third grade students’ outcomes on measures of attention and also their findings showed significant differences between those who did and did not participate in mindfulness practice training, but a marginal effect of each session was not calculated.

In our perspective, the work of Luberto and McLeish (2018) could be considered as a measure of a single mindfulness session. They believe that different session mindfulness training may reduce emotional distress, craving, and withdrawal symptoms among smokers when they are nicotine-deprived. Specifically, they examined the efficacy of brief mindfulness training for 86 non-nicotine-deprived adult daily smokers and explored its effects on smokers’ ability to tolerate emotional distress.
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Disclosure statement

No potential conflict of interest was reported by the authors.

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**Appendix 1. Model Specification**

Starting with the general linear regression model, as follows:

\[
Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_p X_p + \mu 
\]  

(1)

And considering that Y is dichotomous and given its characteristics, the linear regression model is inadequate for various reasons. The Linear Probability Model (LPM) is simple to estimate and use but, its most important disadvantage is to provide outcomes of the fitted probabilities less than 0 or greater than 1, and the predicted probabilities are out of range. To solve these kinds of limitations of the LPM, a more sophisticated binary response model could be used (Greene & Hill, 2010). The logit model based on the logistic distribution is specified as:

\[
P_i = F_i(Y = 1|X_i) = F(\sum_{i=1}^{n} \beta_i X_i) = \frac{1}{1 + e^{-Z_i}} \quad \text{(cumulative logistic density function)}
\]  

(2)

where

\[
Z_i = a + \sum_{i=1}^{n} \beta_i X_i + \epsilon_i
\]  

(3)

\[
P_i = \frac{e^{Z_i}}{1 + e^{Z_i}} \quad \text{and} \quad (1 - P_i) = \frac{1}{1 + e^{Z_i}}
\]  

(4)

The odds ratio is given by

\[
\frac{P_i}{1 - P_i} = e^{Z_i}
\]  

(5)

Taking a natural logarithm of Equation (4) we obtain

\[
Z_i = \ln \left( \frac{P_i}{1 - P_i} \right) = a + \sum_{i=1}^{n} \beta_i X_i + \epsilon_i = L_i
\]  

(6)

Where \( P_i = \) is the probability that \( Y_i = 1 \), ‘a student improves their academic performance with mindfulness practice’ and \( 1 - P_i = \) is the probability that \( Y_i = 0 \), ‘a student does not improve his academic performance with mindfulness practice.’ \( \beta_i = \) are the coefficients estimated by the maximum likelihood procedure of the explanatory variables, \( X_i = \) are the explanatory variables included as possible determinants of the effectiveness of practical mindfulness, \( e = \) is the base of the natural logarithm, \( \epsilon_i = \) is the error term, and \( \ln(P_i/(1 - P_i)) = \) is the log odds ratio of the probability that a student improves their academic performance with mindfulness practice.