Trait Mindfulness in an Engineering Classroom

An exploration of the relationship between mindfulness, classroom skills, and future plans

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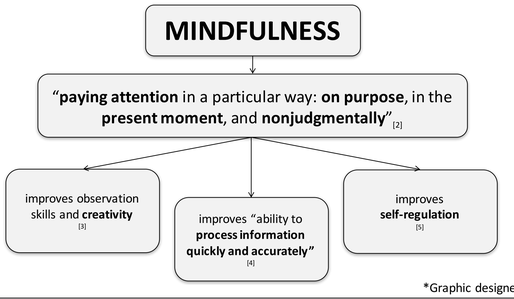
What is mindfulness and why do we care?

Mindfulness has gained significant attention in both the popular press and in academic literature over the last decade. Among the reported benefits of mindfulness are **enhanced cognitive flexibility**, **improved concentration**, and **increased emotional intelligence**[1]. One can imagine that these characteristics would be beneficial to engineers as they tackle increasingly complex and interdisciplinary challenges. However, there is very little empirical literature about the relationship between mindfulness and engineering education. We are interested in answering the question: ***is mindfulness relevant to engineering students?*** Through exploratory empirical research, we aim to discover the relationship, if any, between mindfulness, class performance, and future plans in an undergraduate engineering course.



*Graphic designed by Sophia Pink

How do we measure mindfulness?

Participants were undergraduates in Introduction to Solid Mechanics (Table 1). The students completed two mindfulness questionnaires: the Mindful Attention Awareness Scale (MAAS)[6] and the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R)[7].

TABLE 1. Demographic Characteristics of Students (N=75)

Characteristic	n	%
Gender		
Male	44	58.6
Female	27	36.0
Other	1	1.3
Did not answer	3	4.0
Ethnicity		
White	27	36.0
Asian	19	25.3
URM*	23	30.6
Prefer/Did not answer	6	8.0
First Generation		
Yes	5	6.7
No	67	89.3
Did not answer	3	4.0

*URM=African American, Hispanic, Native American, & Pacific Islander.

MAAS Example Questions:
Rate how frequently you have each experience from 1 (*Almost Always*) to 6 (*Almost Never*):

"*I rush through activities without being really attentive to them*,"

"*I tend to walk quickly where I am going without paying attention to what I experience along the way*."

"*I do jobs or tasks automatically, without being aware of what I'm doing.*"

In addition to the mindfulness questionnaires, we also asked students to self-report their mechanics self-efficacy, business skills self-efficacy, closeness to others in the classroom, and career intent via a post-course survey.

Is mindfulness relevant to engineering students?

RQ1: How do engineers self-report mindfulness and how does this compare to other student populations?

TABLE 2. MAAS and CAMS-R Mindfulness Scores

	MAAS		CAMS-R	
Population	M (SD)	95% CI	M (SD)	95% CI
Overall	3.85 (.65)	[3.70, 4.01]	2.70 (.65)	[2.58, 2.80]
Male	3.87 (.62)	[3.67, 4.08]	2.69 (.46)	[2.55, 2.84]
Female	3.81 (.68)	[3.53, 4.08]	2.62 (.36)	[2.46, 2.76]
URM	3.86 (.80)	[3.49, 4.23]	2.65 (.57)	[2.49, 2.81]
First Gen	4.04 (.72)	[3.15, 4.93]	2.96 (.67)	[2.13, 3.79]

Mean mindfulness was not significantly different between the overall population and any of the sub-populations (p>.05).

There is no significant difference in the self-reported mindfulness of the engineering undergraduates in our sample and other published self-report mindfulness scores in general undergraduate populations.

TABLE 3. Mindfulness Scores Compared to Other Studies

MAAS				
Study	Sample Background	n	M	SD
This Work	Engineering	68	3.85	.65
Brown & Ryan 2003	Psychology	90	3.85	.68
MacKillop 2007	General	727	4.00	.85
Shapiro 2008	General	29	3.60	.88
Schmertz 2008	Psychology	50	3.70	.64
Howell 2011	Psychology	427	3.87	.74
CAMS-R				
Study	Sample Background	n	M	SD
This Work	Engineering	70	2.70	.45
Feldman 2007	General	212	2.58	.52
Schmertz 2008	Psychology	50	2.60	.33

RQ2: How is mindfulness related to self-efficacy and performance in the engineering classroom?

TABLE 4. Intercorrelations for Mindfulness Scores and Classroom Measures

	M (SD)	1	2	3	4	5	6	7	8
1. MAAS	3.85 (.65)	–							
2. MAAS-4	4.05 (.79)	.84**	–						
3. CAMS-R	2.70 (.45)	.49**	.52**	–					
4. Final Grade	0.88 (.05)	-.03	-.05	-.12	–				
5. Mechanics SE	5.41 (.47)	.07	.07	.17	.24*	–			
6. Business Skills SE	3.09 (.73)	.44**	.46**	.44**	-.28*	.16	–		
7. Communicate SE	3.80 (.84)	.37**	.36**	.47**	-.18	.20	.74**	–	
8. Lead SE	3.86 (.82)	.28*	.34**	.30**	-.35**	.14	.69**	.52**	–
9. Closeness	3.43 (.60)	.36**	.30**	.26*	.12	.23	.37**	.44**	.22

*p<.05. **p<.01.

Mindfulness does not correlate with Mechanics Self-Efficacy or Final Grade.

Mindfulness positively correlates with Business Skills Self-Efficacy (BSSE), and two sub-domains of BSSE (*communicate ideas effectively* and *lead a team*).

Mindfulness positively correlates with the closeness construct.

RQ3: How is mindfulness related to engineering student's future plans?

TABLE 5. Intercorrelations for Mindfulness Scores and Career Intent

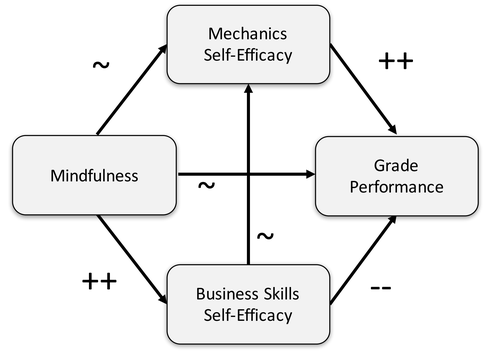
	1	2	3	4	5	6
1. MAAS	–					
2. Non-Profit Org	.17	–				
3. Government Inst	.20	.37*	–			
4. Entrepreneur	.24*	.16	.00	–		
5. Small Business	.24*	-.04	-.06	.41**	–	
6. M/L Business	.11	-.16	.00	-.32**	.17	–
7. L Global Business	.07	-.23*	.12	-.02	.23	.51**

*p<.05. **p<.01.

There is a positive correlation between mindfulness and intent to work "*as an employee for a small business or start-up*" and to "*start my own business as an entrepreneur or be self-employed*".

Conclusions & Future Work

- Engineering students self-report mindfulness with the same means as general undergraduate samples.
- A surprising finding is that mindfulness is *not* correlated with the course final grade. This seems contrary to evidence showing a link between mindfulness and classroom skills such as attention and self-regulation[5].
- Another notable finding is that mindfulness is correlated with Business Skills Self-Efficacy which is *negatively* related to final course grade:



Key
~ No Relationship
+ Positive Relationship (p > .05)
++ Very Positive Relationship (p > .01)
- Negative Relationship (p > .05)
-- Very Negative Relationship (p > .01)

- Mindfulness is correlated with start-up and small business career intent.
  - Does working in a small, tight-knit environment appeal to students with stronger interpersonal and empathy skills?
  - Do students with higher mindfulness have enhanced creativity behavior and desire more self-regulated careers?

This is an initial study to begin to address the quesiton: *is mindfulness relevant to engineers?* The data from this study raise many questions. Why is there no link between mindfulness and classroom performance (grade) despite improved attention and self-regulation associated? What are the mediating variables linking mindfulness with business skills and intent to pursue a career in a start-up environment? We are excited to expand this exploration to larger, more diverse populations of engineering students.

References

[1] Davis, D. M., & Hayes, J. A. (2011). What are the benefits of mindfulness? A practice review of psychotherapy-related research. *Psychotherapy*, *48*(2), 198–208.
[2] Kabat-Zinn, J. (1994). *Wherever You Go, There You Are: Mindfulness Meditation In Everyday Life*. New York: Hyperion.
[3] Baas, M., Nevicka, B., & Velden, F. S. T. (2014). Specific Mindfulness Skills Differentially Predict Creative Performance. *Personality and Social Psychology Bulletin*, *40*(9), 1092–1106. [4] Shapiro, S. L., Brown, K. W., & Astin, J. A. (2008). Toward the Integration of Meditation into Higher Education: A Review of Research. *Teachers College Record*, *113*(3), 493–528.
[5] Noone, C., Bunting, B., & Hogan, M. J. (2016). Does Mindfulness Enhance Critical Thinking? Evidence for the Mediating Effects of Executive Functioning in the Relationship between Mindfulness and Critical Thinking. *Cognition*, 2043.
[6] Brown, K. W., & Ryan, R. M. (2003). The Benefits of Being Present: Mindfulness and its Role in Psychological Well-Being. *Journal of Personality and Social Psychology*, *84*(4), 822–848.
[7] Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J.-P. (2006). Mindfulness and Emotion Regulation: The Development and Initial Validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). *Journal of Psychopathology and Behavioral Assessment*, *29*(3), 177–190.

Further Information

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