

Validating existing assessments of non-cognitive psychological and motivational frameworks for undergraduate STEM populations

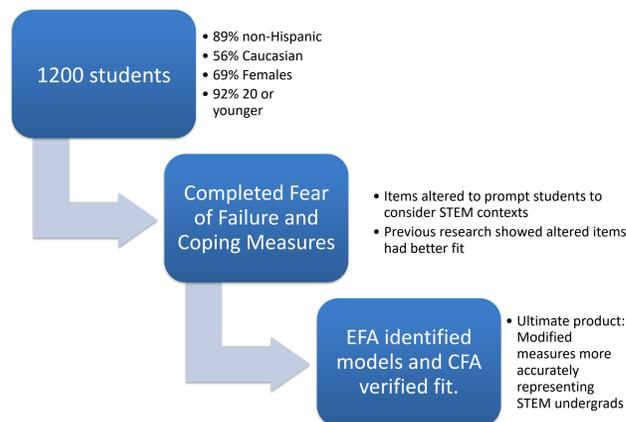
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Revalidating measures specifically for STEM undergrads provides a more accurate picture of factors affecting response to failure/challenge

Introduction

- ❖ Navigating scientific challenges and coping with failure are hallmarks of a successful scientist. However, ways that instructors can explicitly foster such a perseverant mindset are historically unexplored.⁽¹⁾
- ❖ Recent research proposes that encouraging positive changes in *intrapersonal factors*, such as **fear of failure and coping style**, helps STEM undergrads develop resilient, challenge-engaging mindsets.⁽¹⁾
- ❖ While validated assessment measures for these factors exist, they were developed and standardized outside of the STEM undergraduate context. **The purpose of this study is to re-validate existing measures for Fear of Failure and Coping Style in undergraduate STEM populations and create versions of these measures that allow accurate measurement in STEM contexts.**

Methods



Discussion

- ❖ STEM students respond in unique ways that existing tools may not accurately represent – **Edits to the surveys were made!**
- ❖ In both cases, re-validation led to the removal of both individual items and whole subscales
- ❖ If assessment tools are not correctly validated for STEM students, DBER research which uses these tools may come to erroneous conclusions
- ❖ Researchers are encouraged to consider if factors they are investigating may vary/be unique in STEM contexts and, if so, measure re-validation is a strongly advised

References

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Fear of Failure

Emotional and cognitive responses to perceived threats that decrease achievement. Students may be afraid of failure for many reasons.^(2, 3)

Existing Measure: Performance Failure Assessment Inventory (PFAI)⁽⁴⁾

- ❖ 25 items
- ❖ Self-report
- ❖ Scale: 5 point from 1 "Never true of me" to 5 "True of me all of the time."
- ❖ Assesses 5 subscales or reasons for fear of failure in STEM courses

Exploratory Factor Analysis

1) How many factors (or subscales) should our instrument have?

Investigate Eigenvalues—any models with values >1.0 warrant further study

- ❖ Values suggest models with 1-5 factors

2) Out of all the possible models, which one "fits" the "best"

3) Do factors in proposed model make conceptual sense? →

4 Factor Model

Table 1. PFAI EFA model fit statistics (Metric of "good" fit)

Model	AIC (Lower)	RMSEA (90% CI) (< 0.06)	CFI (> 0.9)	SRMR (< .08)
3 factors	88741.92	0.080 (0.077-0.083)	0.877	0.044
4 factors	87379.252	0.051 (0.048-0.055)	0.954	0.023
5 factors	87162.627	0.047 (0.043-0.051)	0.965	0.019

*Model fit for factor structures with 1-4 factors was poor

Table 2. PFAI CFA model fit statistics (Metric of "good" fit)

Model	AIC (Lower)	RMSEA (90% CI) (< 0.06)	CFI (> 0.9)	SRMR (< .08)
3 factors	56311.833	0.080 (0.075-0.085)	0.910	0.960
4 factors	52459.976	0.054 (0.049-0.060)	0.960	0.040

Confirmatory Factor Analysis

4) How well does the revised measure fit the data once we confine the model to specific factors (or subscales)?

Table 3. Modified PFAI; (15 items and 4 subscales)

Subscale	Sample Item
Fear of an Uncertain Future (FUF)	<i>When I am failing...it upsets my "plan" for the future.</i> <i>When I am not succeeding...my value decreases for some people.</i>
	<i>When I am failing...important others are disappointed.</i>
Fear of Experiencing Shame and/or Embarrassment (FSE)	<i>When I am failing...I worry about what others think about me.</i>

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Coping Style(s)

Behavioral responses to stressors (e.g., failures) that allow one to tolerate or minimize stress

- ❖ *Adaptive*: maintains academic achievement and well-being and/or moves beyond a stressor
- ❖ *Maladaptive*: exacerbate threats to academic achievement and well-being and prevent resolution of stressor^(5, 6)

Existing Measure: Brief COPE Inventory⁽⁷⁾; Student Coping Instrument (SCOPE)⁽⁸⁾

- ❖ 40 items
- ❖ Self-report
- ❖ Scale: 4 point from 1 "I don't do this at all" to 4 "I do this a lot"
- ❖ Assesses frequency of various coping behaviors in reaction to failures or challenges in STEM courses

Exploratory Factor Analysis

1) How many factors (or subscales) should our instrument have?

- ❖ Eigenvalues suggest models with 1-10 factors

2) Out of all the possible models, which one "fits" the "best"

Table 4. Coping EFA model fit statistics (Metric of "good" fit)

Model	AIC (Lower)	RMSEA (90% CI) (< 0.06)	CFI (> 0.9)	SRMR (< .08)
7 factors	106549.916	0.051 (0.049-0.054)	0.896	0.032
8 factors	105866.302	0.043 (0.040-0.045)	0.933	0.025
9 factors	105601.953	0.040 (0.037-0.042)	0.946	0.022
10 factors	105427.842	0.038 (0.035-0.040)	0.955	0.019

*Model fit for factor structures with 3-6 factors was poor

3) Do factors in proposed model make conceptual sense? → the 7 and 8 Factor Model both make sense:

- ❖ **7 factor**: defines new factors outside current canon
- ❖ **8 factor**: presents abbreviated version for this special population

- ❖ Measure choice may depend on study goals & research questions

Table 5. Coping CFA model fit statistics (Metric of "good" fit)

Model	AIC (Lower)	RMSEA (90% CI) (< 0.06)	CFI (> 0.9)	SRMR (< .08)
7 factors	75443.335	0.052 (0.050-0.055)	0.901	0.048
8 factors	47480.159	0.034 (0.029-0.038)	0.978	0.027
10 factors	74821.699	0.036 (0.033-0.039)	0.956	0.036

Table 6. Sample items from revised 8-Factor Coping measure; 20 items)

Subscale	Sample Items
Problem-solving	<i>I think about the reason(s) why the situation occurred.</i> <i>I am aware of my feelings regarding the situation.</i> <i>I reduce the amount of effort I put into solving the problem.</i> <i>I give up trying to reach my goal.</i>
Emotional/Social Support	<i>I get emotional support from others.</i> <i>I get help and advice from other people.</i>
Spirituality	<i>I try to find comfort in my religion or spiritual beliefs.</i> <i>I pray or meditate.</i> <i>I try to see it in a different light, to make it seem more positive.</i> <i>I look for something good in what is happening.</i>