Development and Validation of the STEM Study Strategies Questionnaire for STEM College Students

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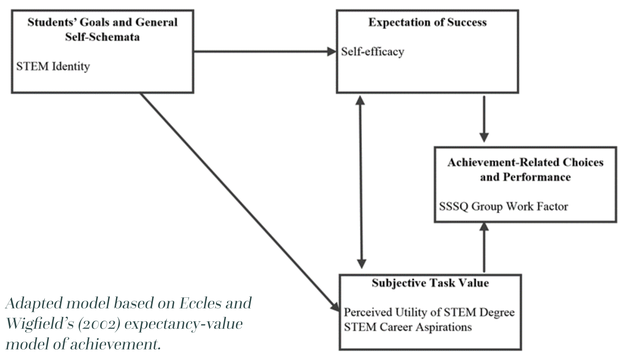
ABSTRACT

In this research-based paper, we discuss the development of a measure of Rice University students' STEM study strategies and then explore the measure's correlation with several important psychological outcomes in a sample of underprepared first-year STEM students (n=94). STEM attrition remains a pressing concern nationally, particularly for students who took less rigorous STEM courses in high school, a population that disproportionally comprises underrepresented minorities.

The authors developed an 11-item measure of STEM-specific study strategies, termed the STEM Study Strategies Questionnaire. We explored STEM-specific identity, self-efficacy, and career aspirations, as well as perceived utility of attaining a STEM degree, using a model based on Eccles and Wigfield's (2002) expectancy-value framework of achievement. An exploratory factor analysis found a four-factor solution to the newly developed scale: Group Work in STEM, Active STEM Learning, Interactions with STEM Professors, and STEM Exam Familiarity. The authors found significant moderate to strong correlations among all psychological variables, as well as with the Group Work and STEM Exam Familiarity factors.

Next steps for this research are to develop further measure items to capture each of the four factors and to conduct confirmatory analyses on different samples of STEM students, both those who are relatively underprepared and appropriately prepared for college STEM coursework.

PROPOSED MODEL



Adapted model based on Eccles and Wigfield's (2002) expectancy-value model of achievement.

An exploratory factor analysis of a new STEM study strategies scale found a four-factor solution: 1) Group Work in STEM, 2) Active STEM Learning, 3) Interactions with STEM Professors, and 4) STEM Exam Familiarity. The Group Work and Exam Familiarity factors predicted students' identity and self-efficacy in STEM, as well as their STEM career aspirations.

EXPLORATORY FACTOR ANALYSIS

Factors and Items	1	2	3	4
Factor 1: Group Work in STEM				
1 I talk to other students in my study group to ensure I understand major concepts.	**.889**	.045	.123	.033
2 I work on class assignments in groups.	**.784**	.284	.075	.061
3 I help others in my study group understand concepts and solve homework problems.	**.764**	-.123	.302	.143
Factor 2: Active STEM Learning Strategies				
4 I rework group assignments on my own to be sure I understand them.	.210	**.781**	-.017	.118
5 I rework homework problems before tests to make sure I can still do them.	.129	**.717**	-.036	.155
6 I complete any required reading before class to ensure I understand the major concepts.	-.171	**.566**	.214	.078
7 I have a structured plan to solve word problems on homework and tests.	.233	**.497**	.470	-.507
Factor 3: Interactions with STEM Professors				
8 I ask my instructors questions during or after class.	.149	-.080	**.844**	.177
9 I go over my completed tests and assignments with the instructor.	.201	.186	**.789**	.040
Factor 4: STEM Exam Familiarity				
10 I pick up my previous tests and rework problems I got wrong.	.088	.357	.371	**.733**
11 I take timed practice tests.	.429	.297	.071	**.587**

CORRELATIONS

		1	2	3	4	5	6	7	8	9
1	STEM Identity	[.92]								
2	STEM Self-Efficacy	.59**	[.92]							
3	Perceived Utility of STEM Degree	.51**	.53**	[.93]						
4	STEM Career Aspirations	.60**	.60**	.70**	[.80]					
5	SSSQ Group Work	.48**	.49**	.36**	.37**	[.84]				
6	SSSQ Active STEM Learning Strategies	.22*	.09	.14	.18	.38**	[.67]			
7	SSSQ Interactions with Professors	.29**	.21	.15	.17	.28**	.29**	[.74]		
8	SSSQ Exam Familiarity	.24*	.24*	.37**	.38**	.51**	.43**	.45**	[.63]	
9	SSSQ Composite	.44**	.37**	.34**	.37**	.75**	.68**	.73**	.78**	[.79]

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