MOOC Evaluation Research Group

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Psychometric Analyses of the Expectancy-Value-Cost Scale in Advanced Nanotechnology MOOCs

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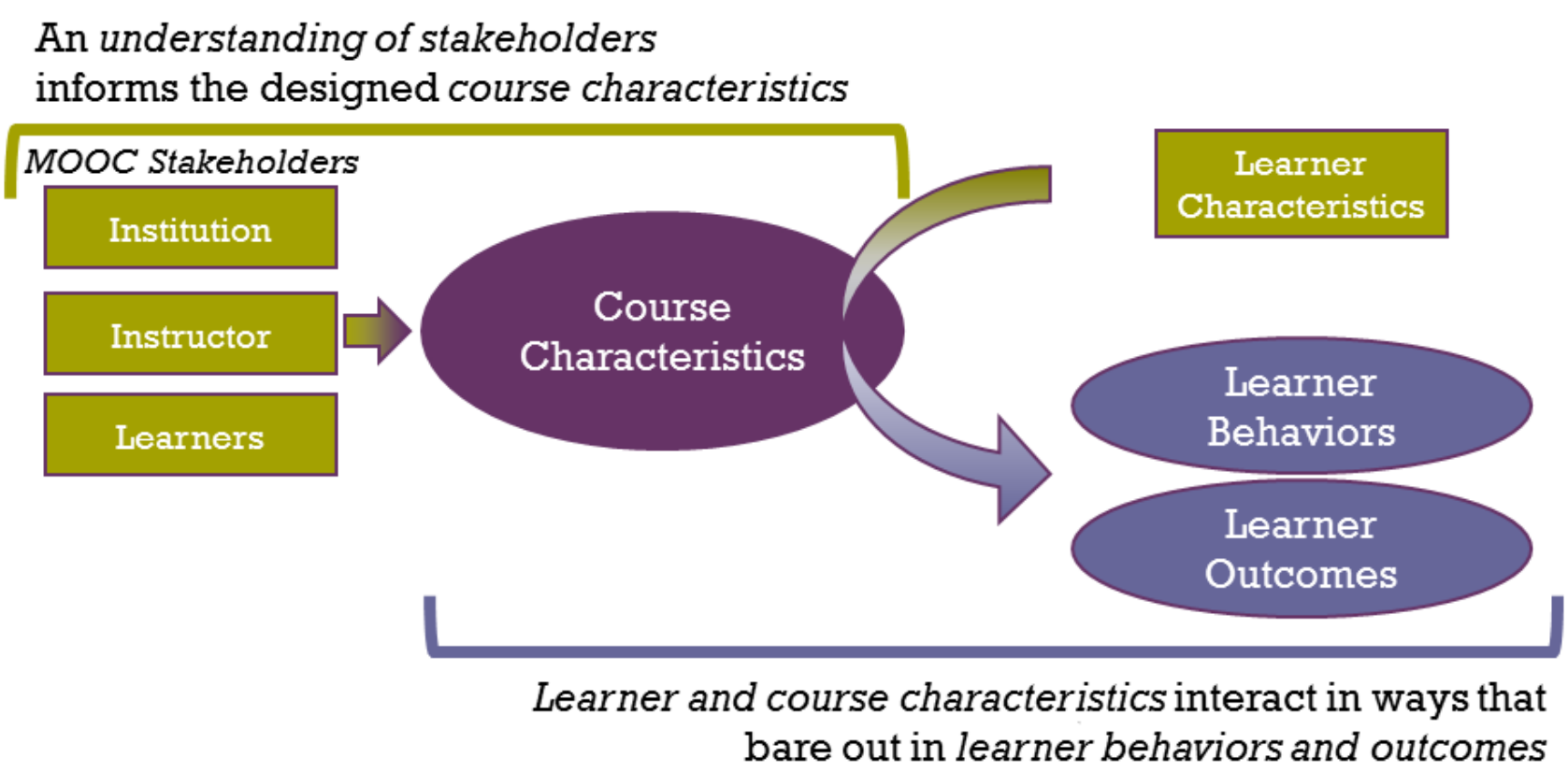
PURDUE ENGINEERING EDUCATION

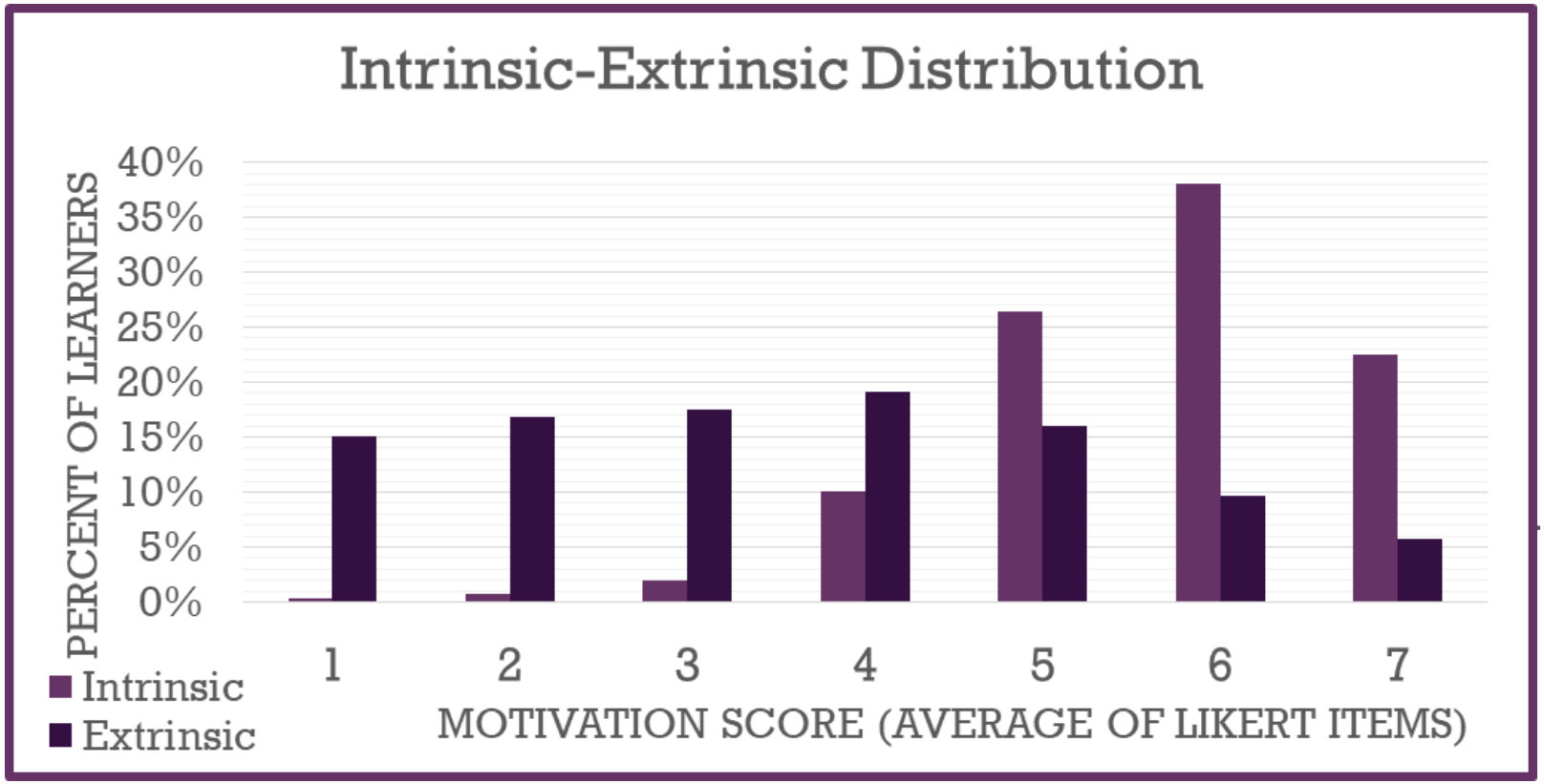
The Expectancy-Value-Cost model of motivation may provide good information about learners in advanced STEM MOOCs, but may require revision for these populations

How do we know this?

Why measure motivation?



How to model motivation?



1. Deci, E. L., & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. New York and London: Plenum.
2. Douglas, K. A., Mihalec-Adkins, B. P., Hicks, N. M., Diefes-Dux, H. A., Bermel, P., & Madhavan, K. (2016). Learners in advanced nanotechnology MOOCs: Understanding their intentions and motivation. In *American Society for Engineering Education's 123rd Annual Conference & Exposition,* New Orleans, LA.

How to model motivation?

- Alternative Model: Expectancy-Value-Cost model[3]
  - Expectancy = one's *belief* they can accomplish a task currently (ability beliefs) or in the future (expectancy beliefs)
  - Value = how much one *wants* to do the task based on whether its perceived enjoyment (interest), usefulness (utility), and ability to affirm one's identity (attainment)
  - Cost = what one believes they will have to give up or expend in order to accomplish the task, including time, effort, or self-image

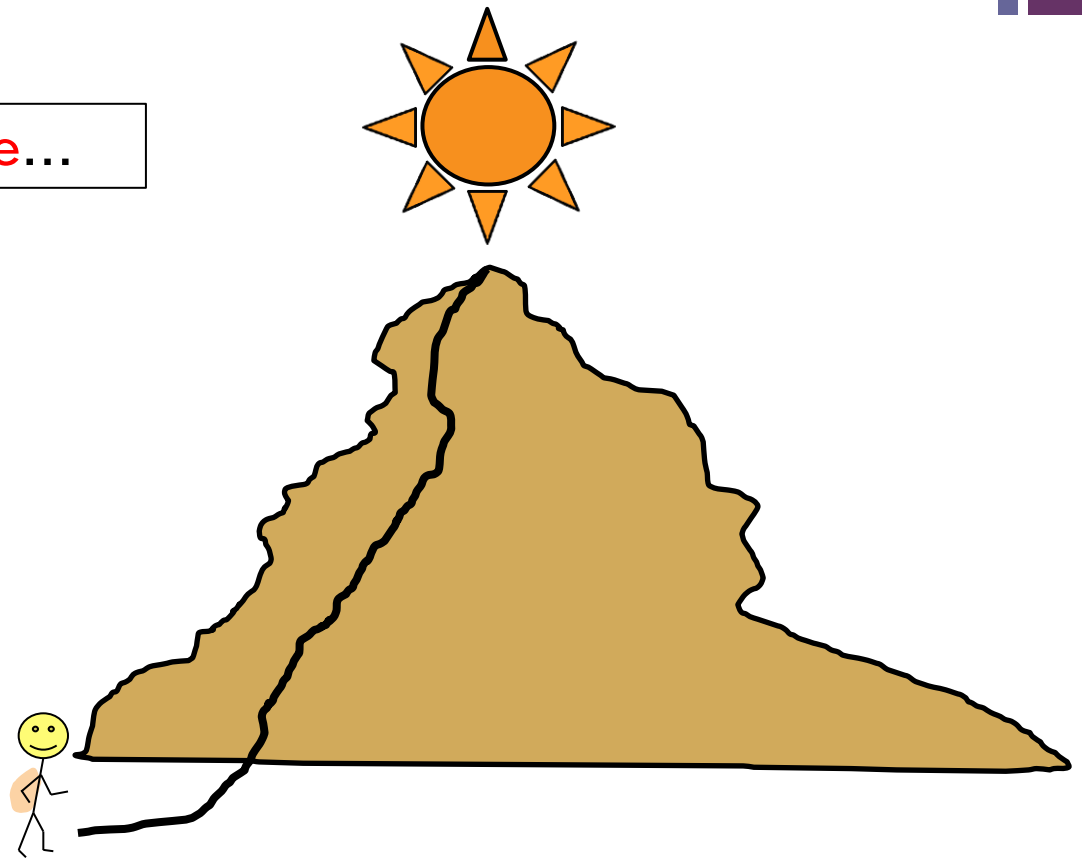
3. Barron, K. E., & Hulleman, C. S. (2015). Expectancy-Value-Cost Model of Motivation. In J. D. Wright (Ed.), *International encyclopedia of the social and behavioral sciences, 2nd edition*, Vol. 8 (pp. 503–509). Oxford: Elsevier.

Expectancy-Value-Cost Model

A goal I value…

… and a belief I can make it…

… but what will it cost me?



https://ehtrust.org/wp-content/uploads/2014/07/kids-reading-sm.jpg

Context of study

- Pre-course surveys from two courses:
  - Nanophotonic Modeling
  - Principles of Biosensors
- Discover the underlying traits with factor analysis
- Investigate item functioning with item response theory (IRT)

Demographics

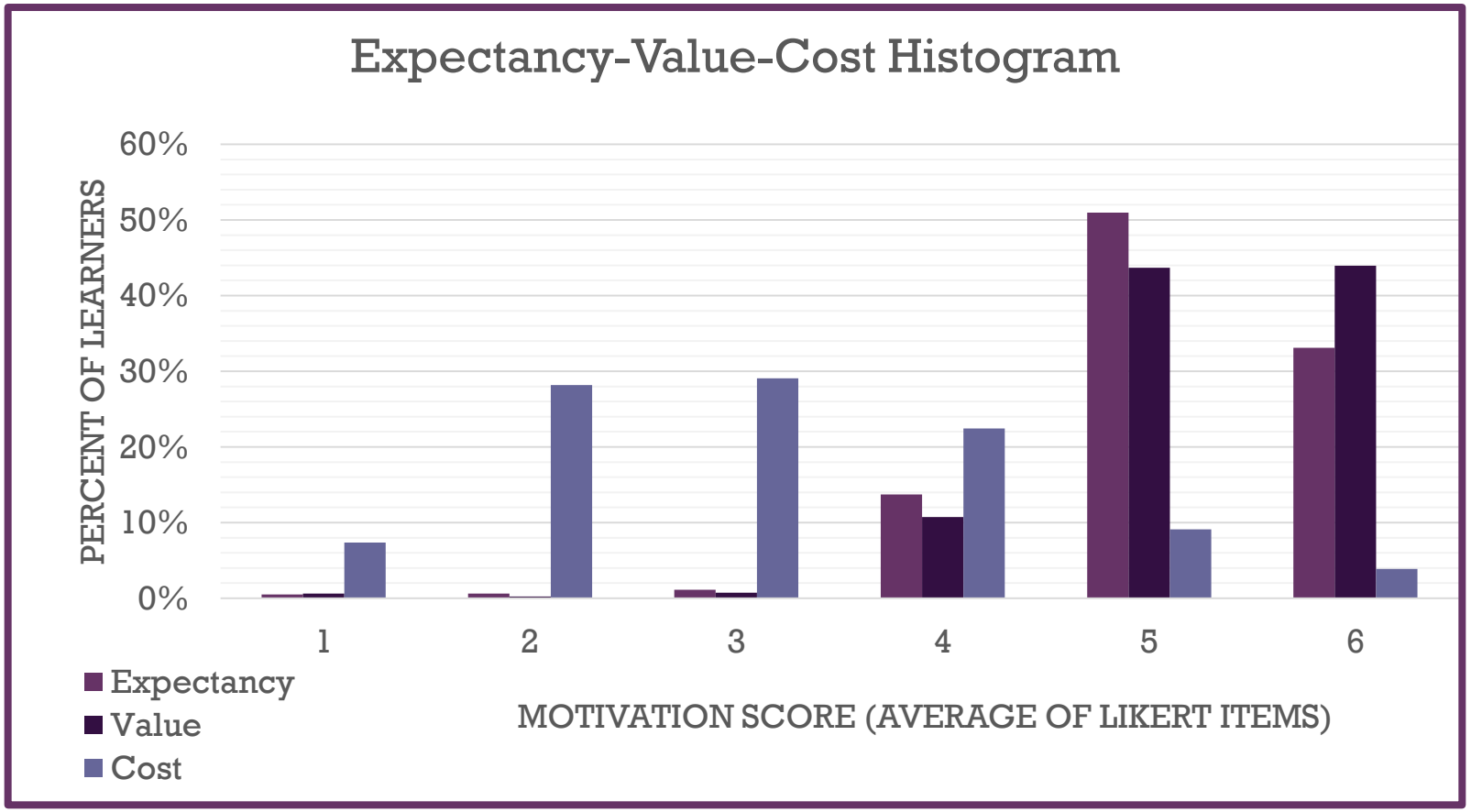
Category	*n*	Percentage
Course		
Nanophotonic Modeling	365	56.8
Principles of Electronic Biosensors	278	43.2
Gender		
Male	302	47.0
Female	67	10.4
Transgender	0	0.0
Prefer not to answer	7	1.1
Non-respondent	267	41.5

Category	*n*	Percentage
Education		
Less than a four-year degree	75	11.7
Four-year degree	110	17.1
Master's degree	133	20.7
Doctoral or Professional degree	68	10.6
Non-respondent	257	40.0
Academic Status		
Part-time student (either in-person or online)	219	34.1
Full-time student (either in-person or online)	161	25.0
Non-respondent	263	40.9

Demographics

Category	*n*	Percentage	Category	*n*	Percentage
Age			**Employment Status**		
24 or under	131	20.4	Employed part-time, unemployed, or retired	185	28.8
25-34	150	23.3			
35 or older	101	15.7	Employed full-time	196	30.5
Non-respondent	261	40.6	Non-respondent	262	40.7

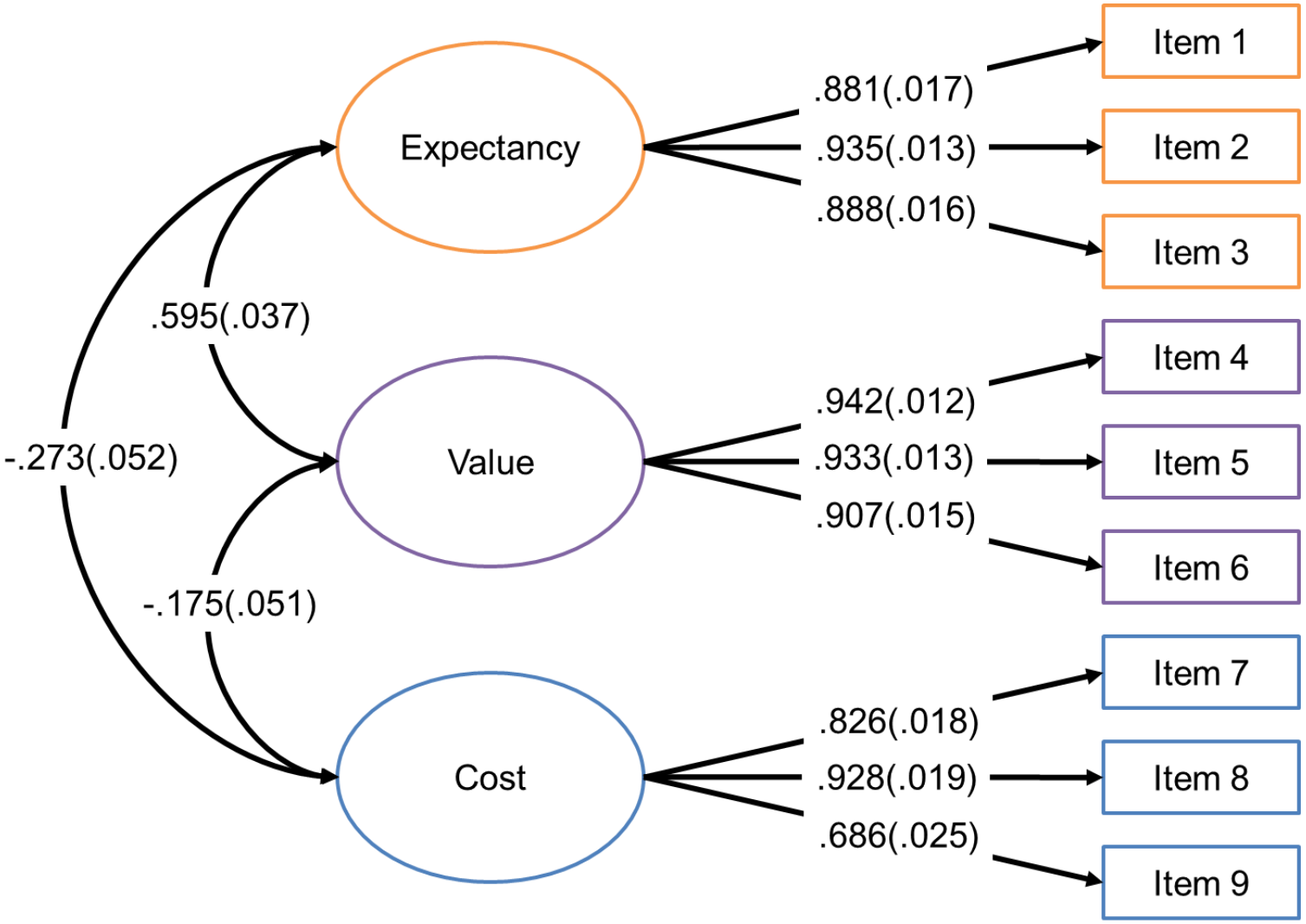
Distribution of Responses



Exploratory Factor Analysis

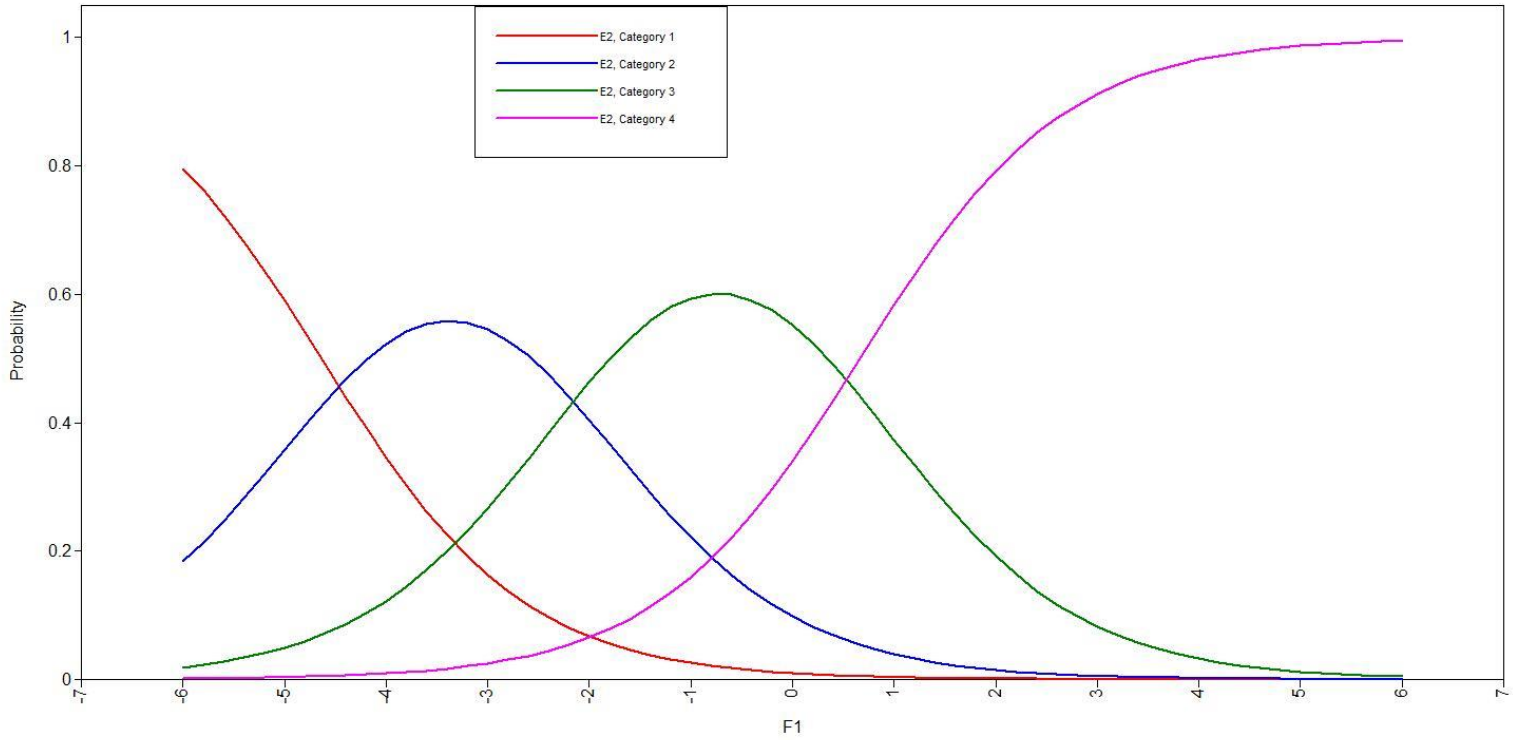
Item	Factor 1 loadings	Factor 2 loadings	Factor 3 loadings
(1) I know I can learn the material in this course.	.879	.514	-.292
(2) I believe that I can be successful in this course.	.944	.524	-.350
(3) I am confident that I can understand the material in this course.	.880	.549	-.263
(4) I think this course is or will be important.	.545	.940	-.261
(5) I value this course.	.551	.928	-.269
(6) I think this course is or will be useful.	.496	.919	-.167
(7) Because of other things that I do, I do not expect to have time to put into this course.	-.168	-.183	.839
(8) I think I will be unable to put in the time needed to do well in this course.	-.270	-.203	.908
(9) I think I may have to give up too much to do well in this course.	-.173	-.067	.693

Confirmatory Factor Analysis



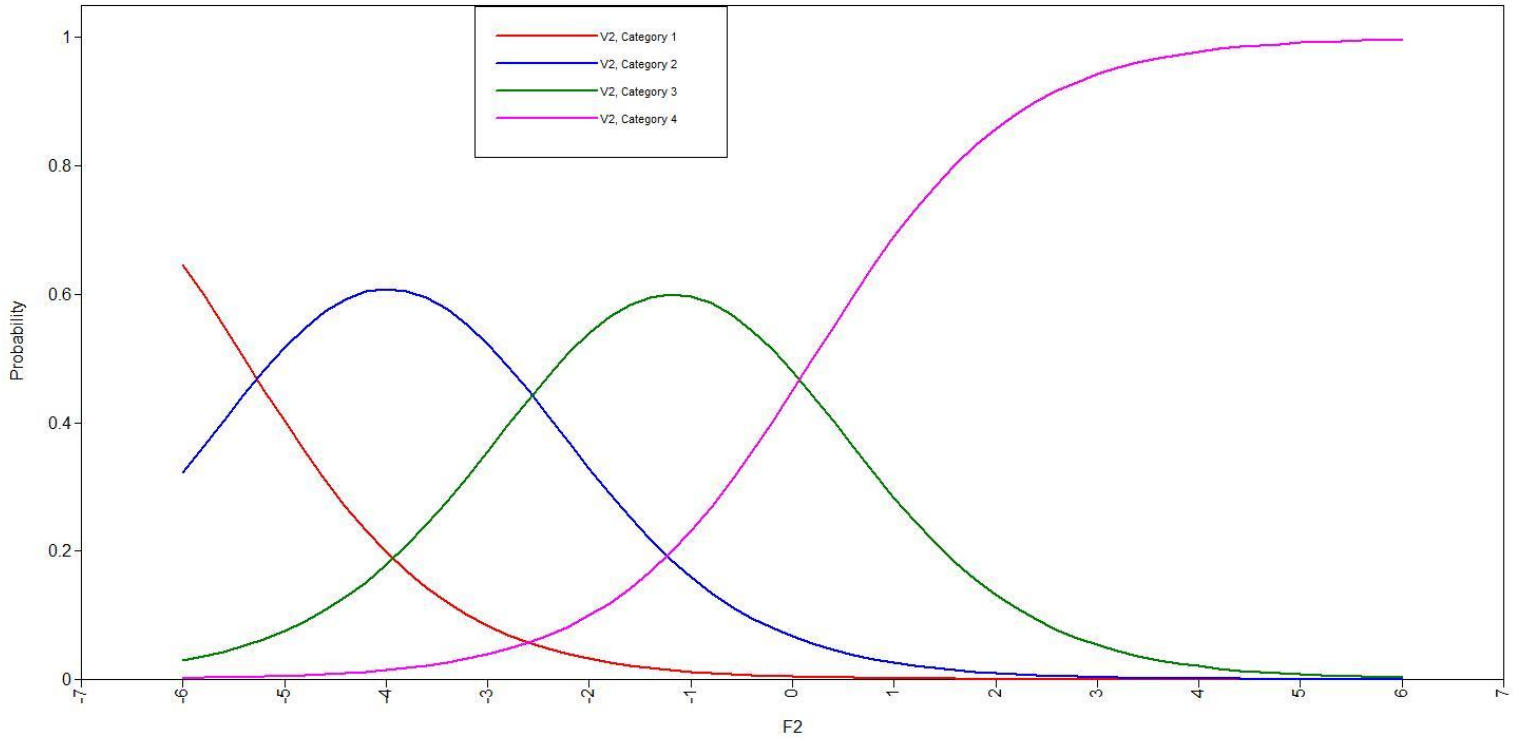
Item Response Theory

Expectancy



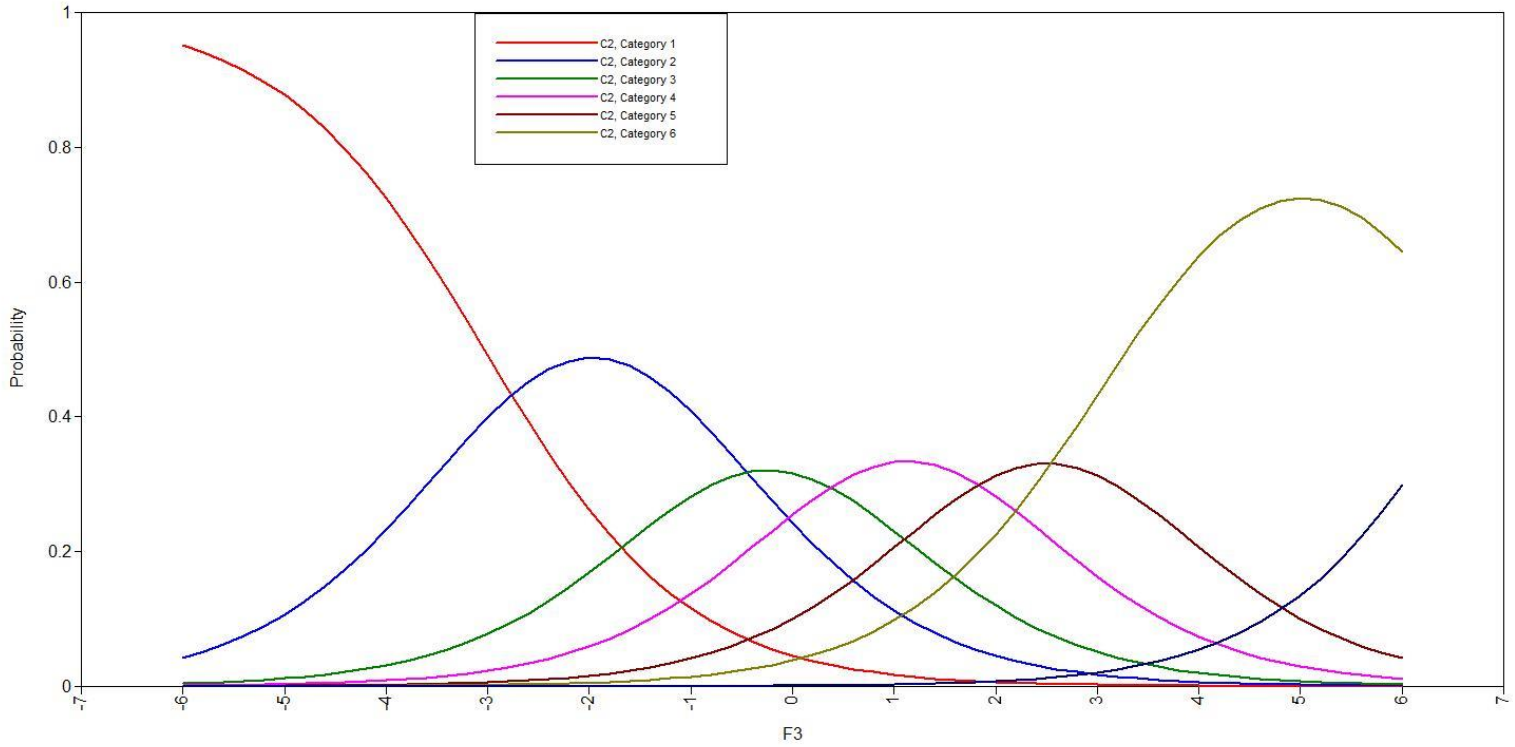
Item Response Theory

Value



Item Response Theory

Cost



What does it all mean?

- The instrument *does* measure expectancy, value, and cost in this population
  - However, slight interpretation variability across sub-populations
- Advanced STEM MOOC learners have strong confidence in their abilities, and value the courses highly, but experience varying influence of cost
- In order for this instrument to provide meaningful information, items need to be revised to better differentiate levels of expectancy and value, given the population

Recommendations and implications

- Given that most participants agree to expectancy and value, questions should be more nuanced to better explore varying sources of agreement
- Measuring motivation with EVC may have direct relationship to learning behaviors
- If we can modify instrument to differentiate each dimension, it can help us
  - Personalize learning experiences
  - Give learners greater autonomy
  - Deliver more targeted interventions

Thank you

Questions?

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