

Exploratory Factor Analysis of the Computer Programming Attitudes Scale: Evidence of Proximal and Distal Outcome Expectations

Stephanie Nonamaker, Ying Cheng, Ph. D., Teresa Ober, Ph. D.
Roanoke College, University of Notre Dame



Introduction

- Curated Pathways to Innovation (CPI) is a web-based app that steers female and underrepresented minority (URM) students towards STEM+C careers
- Students complete surveys to measure their attitudes towards computer programming (CP) as they complete badges in the app
- Research Question:** What is the best fitting factor solution for the full 20-item “computer programming” attitudes scale when fitted to 2019-2020 data?

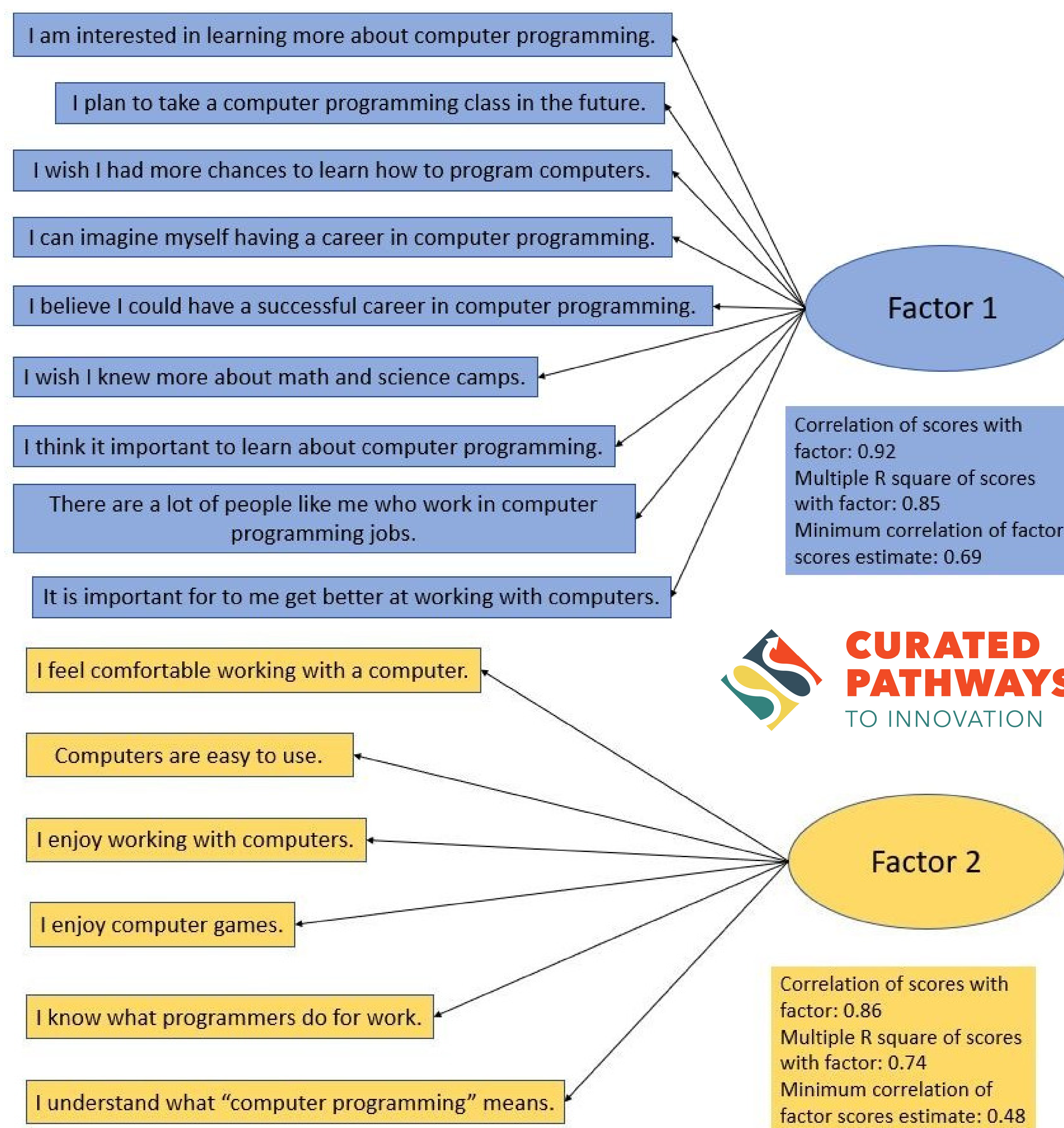
Method

- Exploratory factor analysis (EFA) with varimax rotation
- 472 observations from 2019-2020 baseline and pulse survey data
- 20 items measuring CP attitudes
- EFA conducted for 2-6 factor models
- Model fit evaluated based on content and minimum number of complex loadings



Exploratory Factor Analysis Model Loadings

Model Item	Area	Two		Three		Final		
		M1	M2	M1	M2	M3	M1	M2
I understand what “computer programming” means.	AWARENESS		0.4	0.4	0.1		0.4	
I wish I knew more about math and science camps.	INTEREST	0.6		0.6			0.6	
I wish I had more chances to learn how to program computers.	INTEREST	0.7	0.1	0.7		0.1	0.7	
I know what programmers do for work.	AWARENESS	0.2	0.4	0.2	0.4	0.1	0.2	0.4
It is too difficult to get a job in computer programming.	ASPIRATIONS	0.2		0.1		0.5	-	-
Computer programming is hard.	SELF-EFFICACY	-0		-0		0.7	-	-
I am interested in learning more about computer programming.	INTEREST	0.7	0.5	0.8	0.4		0.8	0.4
I enjoy working with computers.	INTEREST	0.5	0.6	0.6	0.6	-0	0.5	0.6
Computers are easy to use.	SELF-EFFICACY	0.7	0.1	0.7		-0	0.7	
It is important for me to get better at working with computers.	ASPIRATIONS	0.5	0.4	0.5	0.4		0.5	0.4
I believe I could have a successful career in computer programming.	ASPIRATIONS	0.6	0.4	0.7	0.3		0.7	0.3
I enjoy computer games.	INTEREST	0.1	0.4	0.2	0.4		0.2	0.4
I feel comfortable working with a computer.	SELF-EFFICACY	0.3	0.7	0.3	0.7		0.3	0.7
I plan to take a computer programming class in the future.	ASPIRATIONS	0.7	0.4	0.8	0.3		0.7	0.3
I think it is important to learn about computer programming.	ASPIRATIONS	0.6	0.5	0.6	0.5		0.6	0.5
I can imagine myself having a career in computer programming.	ASPIRATIONS	0.7	0.3	0.7	0.3		0.7	0.3
There are a lot of people like me who work in computer programming jobs.	ASPIRATIONS	0.5	0.3	0.6	0.3		0.6	0.3



Results

- 2-factor solution identified as best fit, with one factor measuring proximal CP attitudes and another measuring distal
- 5 items removed from scale, based on loadings less than 0.5 on all factors

Discussion

- Scale measures proximal and long-term, distal CP attitudes
- Student expectations for success in CP related to career outcomes (Perez et al., 2019)
- Accuracy of the scale important for measuring CPI’s effects
- Next step is confirmatory factor analysis on 2020-2021 data

References

- Curated Pathways to Innovation (CPI), <https://yourywca.org/curated-pathways/>
- Perez, T., Wormington, S.V., Barger, M.M., Schwartz-Bloom, R.D., Lee, Y-k, & Linnenbrink-Garcia, L. (2019). Science expectancy, value, and cost profiles and their proximal and distal relations to undergraduate science, technology, engineering, and math persistence. <https://doi.org/10.1002/sce.21490>

Acknowledgements

- LAMBS Lab at University of Notre Dame
- Paul Brenner, Ph.D.
- This work was supported by National Science Foundation grant SMA-1852457: "REU Site: Computational Social Science at the University of Notre Dame."