Dare to *Think Scientifically*: Learning Experiences and Dispositions in Psychology Students

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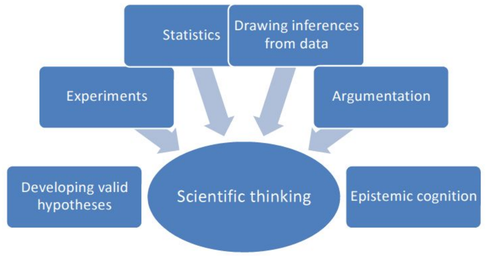
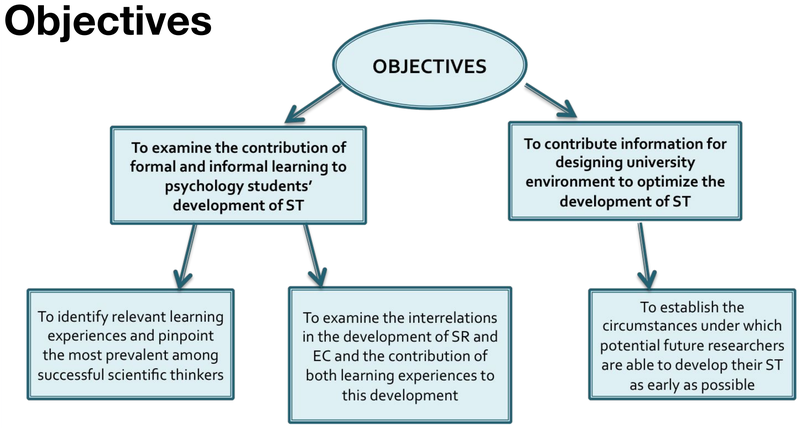
Introduction

Scientific thinking, the thinking involved in any scientific reasoning, is a paramount prerequisite for scientific inquiry (Kuhn & Pearsall, 2000), yet little is known about the ways it is acquired particularly by psychology students as potential future researchers. The present research is, therefore, aimed at fathoming the role learning experiences and personal dispositions play in first-year psychology students' development of scientific thinking.



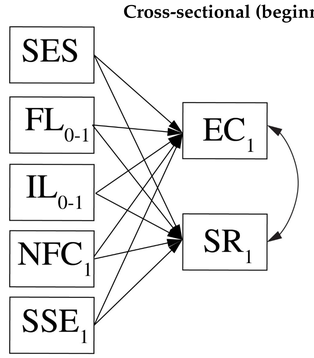
Objectives



Proposed Analysis

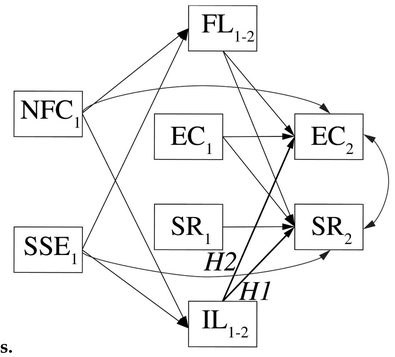
Bayesian latent variable modeling (SEM). Structural models:

Cross-sectional (beginning of second semester):



SES = Socioeconomic status
$FL_{0\text{-}1}$ = Formal learning during first semester
$IL_{0\text{-}1}$ = Informal learning during first semester
NFC_1 = Need for Cognition
SSE_1 = Science Self-Efficacy
EC_1 = Epistemic Cognition
SR_1 = Scientific Reasoning

Longitudinal (beginning to end of second semester):



Additional analysis.
Network modeling, Latent Class Analysis (Epistemic Cognition & Statistics Misconceptions), Prediction of career aspirations (*would you like to become a researcher?*)

Anticipated Results

Our main expectation is that Informal Learning Experiences contribute to students' development of epistemic cognition and scientific reasoning beyond other variables (mainly formal learning experiences, see H1 and H2 depicted in the graphical representation in the analysis). We expect this pattern to emerge in both cross-sectional and longitudinal models.

Open responses added to SRS and SMQ will provide us with insight into what types of errors are most common among psychology students. Together with detailed information about individual learning experiences, this might be helpful to design better informed university environment to tackle specific misunderstandings of scientific concepts covered by those two scales.

Next Steps...

...**preregistrations** of confirmatory analysis on the Open Science Framework.

...further organization and conduct of **assessments**.

...generate the perfect **questions**. Writing, writing, writing.

Methodology

Sample: First year Psychology students, eight countries, eleven universities, assessed twice either in class or online, at beginning and end of second semester. Cohorts vary between 40 and 700.
Status quo: Protocol published. Assessments started (Ireland: Check)! Collaborations with lecturers in various countries.

300	90	120	120	100	100	N = ?	150
Belgium	Bulgaria	Czech Republic	Ireland	Slovenia	Spain	The Netherlands	Turkey

Anticipated number of participants from each country.

Demographics: age, gender, former university education, career aspirations, grades in high school, the grade of first university examination and family socioeconomic status.
Scientific Reasoning Scale (Drummond & Fischhoff, 2015): 11 true/false items.
"A researcher finds that American states with larger parks have fewer endangered species. True or False? These data show that increasing the size of American state parks will reduce the number of endangered species."
Statistics Misconceptions Questionnaire: 5 true/false items.
"A researcher conducts an experiment, analyzes the data, and reports: The 95% confidence interval for the mean ranges from 0.1 to 0.4! True or False? The researcher can conclude that the "null hypothesis" that the true mean equals 0 is likely to be incorrect."

Epistemic and Ontological Cognition Questionnaire (Greene et al., 2010): Three subscales for simple and certain knowledge, justification by authority and personal justification. 6-point response scale.
"In psychology, the truth means different things to different people."
Need for Cognition Short Scale: 4 items, 7-point response scale.
"I would prefer complex to simple problems."
Science Self-Efficacy (Moss, 2012): 10 items, 10-point response scale.
"I am very proud of my science skills and abilities"
Learning Experiences Survey: Formal and informal experiences relevant for scientific thinking. Students rate how often they engaged in various activities out of obligation, interest, or both.
"Reading psychology or science textbooks", "Discussing scientific issues with peers".

References

Drummond, C., & Fischhoff, B. (2015). Development and validation of the scientific reasoning scale. *Journal of Behavioral Decision Making*.
Greene, J. A., Torney-Purta, J., & Azevedo, R. (2010). Empirical evidence regarding relations among a model of epistemic and ontological cognition, academic performance, and educational level. *Journal of Educational Psychology*, *102*, 234.
Kuhn, D., & Pearsall, S. (2000). Developmental origins of scientific thinking. *Journal of Cognition and Development*, 1(1), 113-129.
Moss, E. (2012). Assessing Understanding of the Nature of Science and Science SelfEfficacy in Undergraduates Involved in Research in an Introductory Geology Course. Available at: http://lib.dr.iastate.edu/etd/12825

Acknowledgements

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Contact

Webpage:
bit.ly/JRPST

Protocol paper:
http://bit.ly/JRPSTProtocol

Objectives

The objective of this study is to:

- consider the contributions of formal and informal learning experiences to psychology students' development of scientific thinking during their first year of study.
  - to identify learning experiences related to the development of scientific thinking in the first year of higher education as well as to pinpoint those that are most prevalent among successful scientific thinkers.
  - to examine interrelations in the development of scientific reasoning and epistemic cognition during the semester, and the contribution of students' engagement in both types of learning experiences to this development.
- contribute information for designing university environments to optimise the development of students' sceintific thinking.
  - to establish the circumstances under which potential future researchers in psychological science are able to develop scientific thinking during the early stages of their studies.

Objectives version 2

PS: I made mind map in pp and now I can not put it here unless I save it as a picture.