

Students' Sense of Belonging to Maths in the Transition from Post-Primary to Tertiary Education

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**Scoil na Matamaitice and na
Staitisticí UCD**

Outline of Talk

1. ITE in Maths and Science in UCD
2. Math Sense of Belonging Scale
3. The Study
4. Preliminary Findings
5. Future Work



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1. ITE in Maths and Science in UCD

Four 4-year undergraduate programmes:

- BSc in Applied Maths, Maths and Education
- BSc in Biology, Maths and Education
- BSc in Chemistry, Maths and Education
- BSc in Physics, Maths and Education

Plus a 1-year postgraduate programme:

- MSc in Maths and Science Education



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2. Math Sense of Belonging Scale

“Sense of belonging, as we conceptualize it, involves one’s personal feelings of membership and acceptance in an academic community in which positive affect, trust levels, and willingness to engage remain high” (p. 3).

Good, G., Rattan, A. & Dweck, C.S. (2011), Why do Women Opt Out? Sense of Belonging and Women’s Representation in Mathematics, *Journal of Personality and Social Psychology*, **102** (4), 700-717.



Sense of Belonging to Math

Study 1

Created and validated a new sense of belonging to math scale.

30 items and 5 factors:

1. Membership (6)
2. Acceptance (8)
3. Affect (8)
4. Desire to Fade (4)
5. Trust (4)



Sense of Belonging to Math

Study 2

Explore relationship between college students' sense of belonging to math and intent to pursue math in the future.

Study 3

Longitudinal study that showed how students' perceptions of two factors in their math environment, worked together to erode women's, but not men's, sense of belonging to math.



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3. The Study – Research Questions

In what ways, if any, does the transition from post-primary mathematics to university mathematics affect high achieving students' sense of belonging to maths?

What are the environmental factors, if any, that influence high-achieving students' sense of belonging to maths at post-primary and university level?



The Study - Participants

- 33 out of 38 students taking EDUC10130 completed paper-based survey at the end of first year 2014-2015
- Survey included:
 - Background information
 - SOB to Math at post-primary
 - SOB to Math at university



The Study - Participants

- 7 of the 33 students volunteered to take part in one-to-one interview (conducted by Dr Anthony Cronin)
- Interview focused on:
 - Experience of learning maths at post-primary
 - Experience of learning maths at university
 - Reflections on what makes a good mathematics teacher and lecturer



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4. Preliminary Findings

Quantitative Analysis

- Performed cluster analysis on changes in SOB on transition from post-primary to university



Cluster Analysis

- Clustering was performed using the package ClustMD.
- ClustMD produces BIC values.
- Based on the approximated BIC values, the optimal number of clusters was three.
- The clustering method used was hierarchical clustering.
- The same cluster groupings were also returned using mclust.



Three Clusters - Post-Primary

Cluster	No. Students	Description
1	12	High – Very High SOB
2	15	High SOB – “Affect” and “Proving Oneself” Lower
3	6	Low SOB



Three Clusters - Transition

Cluster	No. Students	SOB to Maths at School	Change in SOB to Maths at End of First Year
1	12	High to very high	No change to slight decrease
2	15	High but "Affect" and "Proving Oneself" Lower	Decrease
3	6	Low	Increase



Choosing Maths and/or Maths and Education in Stage 2

Cluster	No. Students	No. of Students in Maths or Maths & Education	Qualitative Interviews
1	12	11	Kate* Lucy* Sean*
2	15	5	Grace* Joe Julie
3	6	0	Charlie



*Taking Maths and/or Maths and Education in Stage 2

Joe on Confidence

“I was very confident. I was one of the higher performers in the class.” (School)

“I am confident that I can do it but I am not confident I can do it well.” (University)

“Instead of being taught you really are just being thrown what you have to have learn at you instead of actually being talked through it properly and how to do it.”
(University)



Sean on Confidence

“At Leaving Cert I would say I was quite confident. Like I could always get the questions out. I could always do everything in time, like even the Leaving Cert was like 100% fine.” (School)

“I would say less confident to be honest, because obviously there is a lot more challenging stuff.”
(University)

“There has been an awful lot more of my own work going in, but I am sure that is natural with every third level course.”(University)



Joe on Community

“Everyone knew each other and you were able to talk about what you are doing and everyone in the class was able to sort out or discuss what was going on in the class with each other.” (School)

“And like you are in classes of over two hundred and stuff so there is no individuality really. You can’t stand out to your lecturer because your lecturer just sees you as another face in the crowd really, and it is not as helpful at all and it is too impersonal.” (University)



Sean on Community

“I would say there definitely was [a sense of community at school]. Like obviously it is more personal than third level the teachers know you by name. They have known you for years and have seen you pretty much grown up throughout the school.” (School)

“There is definitely a maths community. Like there is so many more people doing maths and obviously so many more lecturers. Whereas in the school there was only about three or four maths teachers. So it is [...] less personal, but there is definitely more of a maths community here.” (University)



Sean on Learning Maths

“Like even when I did find the challenging questions and the tough ones; I love ... I know it sounds a bit weird but I actually love to sit there and like even if it took two hours, just to sit there and try and get my head around doing it. Like I just love the whole problem solving aspect of things.” (School)

“I just did not understand them [matrices at university] at all and I got confused, frustrated and all that, and then eventually I got around to learning it. But at the same time it was tough at the beginning, but the more I got used to it, the more I kind of accepted it and it is far better now than it was.” (University)



Kate on Stress and Confidence

"I noticed that compared to every other subject, it was the most stressful. In the sense that like we had ... like I was in the top honours class. So there was a lot of pressure on us, and we had after school classes every Tuesday. We met over Easter, over Christmas; we came in to have extra classes. But we didn't do that for any other subject." (School)

"I feel it is less stressful now. So I would say probably still as confident maybe ... yeah. Maybe even more confident because it is not counting towards CAO points."
(University)



Grace on Teacher/Lecturer Expectations

“For Leaving Cert like I because I had the same teacher up along like she kind of knew what I should be getting and things. So like if you didn’t have homework done or didn’t have something done, she would know it wasn’t because you couldn’t do it or something. It was because you were just being lazy. So like she would put a bit more pressure on you in that way like.” (School)

“The teacher [lecturer] doesn’t know you. Like there is no expectation on you I suppose, which is good and bad like.” (University)



Key Item at School

I trusted that I did not constantly have to prove myself.



Dropping from Higher to Ordinary Level

“She literally ... everything was the students’ fault and nothing was her fault and she went so far to tell a lot of the higher level students to either drop down or they were going to fail. So basically she completely put at least half the class off doing higher maths.”

(Joe on Teacher for JC Maths)



Dropping from Higher to Ordinary Level

“She didn’t have a lot of time for those who were kind of struggling. Like even at Junior Cert like there were times when she would say she needed to eject people out of the class like, because she wanted to move on and she felt they were kind of holding the class back and that.”

(Kate on Teacher for JC Maths)



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Future Work

- Further statistical analysis
- Perform analysis on more extensive data set collected from 2015-16 first year cohort

