Why Are Some Online Educational Programs Successful?: Student Cognition and Success

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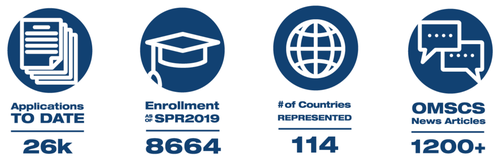
OMSCS vs. MOOCs

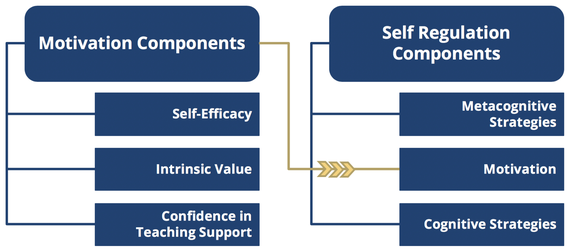
Massive Open Online Courses (**MOOCs**) once offered the promise of accessibility and affordability. However, MOOCs typically lack expert feedback and social interaction, and have low student engagement and retention. Alternative programs for online education have emerged, including the **Online Masters of Computer Science** (**OMSCS**) **Program** at **Georgia Institute of Technology**. This program has been hailed as an immense success, and enrollment continues to grow each year.



We adopt the perspective of cognitive science to answer the question: ***Why do only some online educational courses succeed****?*

Self-Efficacy + Self-Regulated Learning

We adopt a **socio-cognitive perspective** and examine psychological aspects of student cognition in the online program in an attempt to answer the above question. The literature in educational psychology, and socio-cognitive theory relates perceived student self-efficacy and actual self-regulated learning with student success [1,2].



It proposes that (1) students with high perceived self-efficacy are more likely to be successful learners, and (2) learning environments that promote self-regulated learning in practice are more likely to result in student success.

The **socio-cognitive** explanations operationalize the earlier hypotheses and allow us to systematically study them. If **student cognition is characterized by these motivational and cognitive constructs**, then we should observe some evidence for them in the online program in computer science.

Success in Online Education Programs: A Snapshot

We posit that measuring specific motivational and self-regulation components of students in the online AI course will help us **determine if there is a relationship between the online AI course being success and the type of cognition exhibited by the students**. Successful online programs might very well be **the result of increasingly motivated and educated students**. The investigation begins with first modeling student cognition using motivational and self-regulation constructs, and briefly reviewing objective measurements of student performance.

Research Questions

RQ1: *Do students in the online AI course have high self-efficacy and do they use self-regulation in their learning?*

RQ2: *Do student measures for each construct change from the beginning of the term to the end of the term?*

RQ3: *Do student measurements in self-efficacy and self-regulation correlate to one another?*

Hypotheses

H1: *Students in the online AI class have high perceived self-efficacy.*

H2: *Students in the AI class use self-regulation in their learning within the course.*

H3: *The self-efficacy of the students is at least partially informed by the demographics of the online student population, which are different from the demographics of the residential student population.*

H4: *Student cognition for those enrolled in the online AI class is characterized by high measurements of psychological constructs and may contribute to why the course is considered a success.*

We measure learner motivation and self-regulation in one course in the OMSCS, specifically a course on **artificial intelligence (AI).** Surveys of students indicate that students' self-reported assessments of **self-efficacy**, **cognitive strategy use**, **intrinsic value,** and **confidence in teaching support** are not only fairly high, but also generally increase over time.

Survey Information

- Adapted MSLQ instrument
  - Pintrich & DeGroot
  - Motivation Components
  - Self-Regulation Components
  - Multiple Subscales identified
- Student Engagement Survey
  - Self-Efficacy
  - Intrinsic Value
  - Cognitive Strategy Use
  - Learning Assistance

Participants

- One course, Three groups:
  - Spring 2017 online students
  - Fall 2017 online students
  - Fall 2017 residential students
  - 16 weeks each
  - Graduate students

Survey Findings

Spring 2017 Online Student-Engagement Survey N=24

	Mean ± Std. (EoT, BoT)		Mean Diff.	Std. Err.	p-Val	t-Stat	Eff. Size
SE	5.88± .67	5.55± .83	.325	.147	.038	2.206	.450
CS	5.72± .81	5.58± .92	.143	.167	.398	.861	.176
IV	5.86±1.05	5.74± .88	.127	.160	.435	.794	.162
CiTS	6.31± .57	6.14± .83	.167	.139	.242	1.202	.245

Fall 2017 Online Student-Engagement Survey N=70

	Mean ± Std. (EoT, BoT)		Mean Diff.	Std. Err.	p-Val	t-Stat	Eff. Size
SE	5.77± .76	5.46± .81	.280	.099	.003	3.08	.368
CS	5.65± .78	5.62± .78	.031	.085	.721	.359	.043
IV	5.75± .97	6.01± .77	-.260	.098	.010	-2.632	-.315
CiTS	6.10± .80	5.85± .83	.250	.087	.006	2.838	.340

Fall 2017 Campus Student-Engagement Survey N=15

	Mean ± Std. (EoT, BoT)		Mean Diff.	Std. Err.	p-Val	t-Stat	Eff. Size
SE	5.64± .97	5.91± .73	-.267	.256	.005	2.888	.350
CS	5.54±1.03	5.73± .57	-.195	.188	.357	.928	.115
IV	5.84±1.23	6.07± .89	-.229	.193	.025	-2.294	.28
CiTS	5.93±1.04	6.39± .46	-.463	.213	.005	2.879	.35

Demographics

	Online Spring 2017	Online Fall 2017	Campus Fall 2017
Age	<24: 19.0% 25-34: 58.8% >35: 22.2%	<24: 17.9% 25-34: 59.0% >35: 23.1%	<24: 73.0% 25-34: 23.1% >35: 3.9%
Gender	Female: 13.6% Male: 86.4%	Female: 10.3% Male: 88.9%	Female: 23.07% Male: 76.93%
Highest Level of Prior Education	Bachelor's: 80.6% Master's: 15.1% Doctoral: 4.3%	Bachelor's: 76.9% Master's: 19.7% Doctoral: 3.4%	Bachelor's: 88.5% Master's: 11.5% Doctoral: 0%
Years of Programming Experience	<4: 23.7% 4-10: 53.4% 10-15: 13.3% >15: 9.3%	<4: 22.2% 4-10: 53.0% 10-15: 14.5% >15: 10.3%	<4: 88.5% 4-10: 11.5% 10-15: 0% >15: 0%

Response Rate

	1st Survey	2nd Survey	Paired
Spring 2017	78/145 (53.8%)	28/145 (19.3%)	24/145 (17%)
Online Fall 2017	111/253 (43.9%)	112/253 (44.3%)	73/253 (29%)
Campus Fall 2017	31/83 (37.3%)	24/83 (28.9%)	17/83 (20%)

RQ1: That participants initially reported high measurements in all constructs in each group, might suggest that all groups consisted of relatively confident and experienced students. This is supported by the demographic data.

RQ2: In all groups, Self-Efficacy showed a statistically significant increase. In the Spring 2017 Online group, there were no additional statistically significant changes in any construct from the BoT to EoT. In the Fall 2017 Online group, there was a statistically significant decrease in Intrinsic Value, and a statistically significant increase in Confidence in Teaching Support. In the Fall 2017 Campus group, there was statistically significant decreases in both Intrinsic Value and Confidence in Teaching Support.

RQ3: Results from our correlation analysis showed that across all groups, use of cognitive strategies, intrinsic value, and confidence in teaching support all significantly and positively correlated with self-efficacy .

Spring 2017 Online Self-Efficacy Correlation

	Pearson's Correlation	Coefficient Value	Strength of Association
CS	.522	.009	Strong +
IV	.439	.032	Moderate +
CiTS	.642	.001	Strong +

Fall 2017 Online Self-Efficacy Correlation

	Pearson's Correlation	Coefficient Value	Strength of Association
CS	.403	.001	Moderate +
IV	.491	<.0001	Moderate +
CiTS	.531	<.0001	Strong +

Fall 2017 Campus Self-Efficacy Correlations

	Pearson's Correlation	Coefficient Value	Strength of Association
CS	.585	.022	Strong +
IV	.518	.048	Strong +
CiTS	.660	.007	Strong +

Conclusion

H1: Students in the online AI class **do have higher measurements of both the motivational and self-regulation** components. Not all constructs increased significantly from the BoT to the EoT; however, all constructs were rated relatively high in both terms throughout the semester. It suggests that the **students are self-motivating** and **driven to use strategies that positively impact their academic performance**.

H2: Our findings suggest that the students in the online AI course are **self-regulating and have high self-efficacy**, which may be indicative of **positive cognitive engagement** with the course.

H3: This hypothesis is supported by the findings of the demographic data for both online groups, which shows that a majority of students already obtained at least one college degree or had between four and ten years of programming experience. Given that the online program is a graduate-level program, we anticipated this. These are **highly motivated**, **educated and hard working students** who routinely engage in cognitive strategies and utilize the resources available to them within the class.

H4: When we consider the student measurements compared to their grades (*additional research pending publication*), students might feel confident in their abilities to perform well on the class tasks because they carry the **necessary characteristics for excelling** in the course: (1) **experience**, (2) **motivation both intrinsic and extrinsic**, and (3) **developed strategies for success**.

Given that the students themselves carry these indicators for success, it may very well be that **the course is successful not solely because of the curricula or design, but because the students themselves are successful**. The cognition of students who enroll in the online course is characterized by their high measures of motivation and self-regulation.

While it is not possible to generalize from one course to the **OMSCS** as a whole, the above results indicate that at least one popular course in the online program has many successful students, who may be the reason for course success.

Citations

1. Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational psychologist*, *28*(2), 117-148.

2. Pintrich, P., Smith, D., Garcia, T. & Mckeachie, W. (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ). Technical Report # 91-B-004. School of Education, University of Michigan.