Investigations and Development of Strategies to Effectively Teach Introductory Chemistry through an Online Platform

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Abstract

Education and technology over the past few decades have become increasingly entwined. Everything from iPads® to fully electronic universities have become a norm in teaching. With such a profound influence that these electronic learning environments are having, critical evaluation of effective strategies and best practices are necessary. Unfortunately, these studies about technology and education vary greatly in focus and results and the vastness of what has been published is astonishing. What is most fascinating is how quickly technology has been thrown into education without supporting evidence to show how or if it is effective the classroom. Technology needs to be implemented in an academic way such that it benefits the student and the education system overall. While electronic content to supplement student learning has been implemented in the classroom, much of what has been introduced does not allow students to reach their full potential in learning through technology. This is due mostly to a lack of resources and support at the classroom level and a lack of understanding of how technology can be used to teach more effectively. This research aims to correct this lack of understanding by further studying how students learn introductory chemistry and how technology can be used in teaching to improve student learning. Overall this project will focus on how and if electronic material can replace traditional methods. We hypothesize that this is only possible if the instructor is capable of anticipating student pitfalls; implementing strategies to improve comprehension, problem solving, and analytical skills; and anticipating problems that may arise in an electronic learning environment.

Objectives

- Effective Strategies for Online Learning:
- anticipating student pitfalls
- implementing strategies to improve comprehension, problem solving, and analytical skills;
- anticipating problems that may arise in an electronic learning environment
- Identify if and how technology can be implemented into introductory chemistry education
  - Utilize student perspective
  - Assess student perceptions
  - Identify useful software and hardware
- Develop online content for future online introductory chemistry class implementing techniques based on student responses

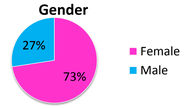
Methods

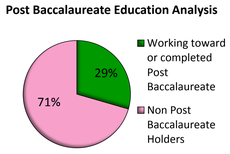
- Surveys
  - SurveyGizmo.com
  - 11 students participated in Pilot Study (from York Tech)
  - 113 people participated in generalized study
- Technology Discovery
  - SmartPen
  - iPad Apps
  - Camtasia (Camstudio)
  - Wacom Bamboo Tablet
- Content Development
  - ShowMe Mini Lessons
  - Pencasts of problem solving, different methods of solving/approach

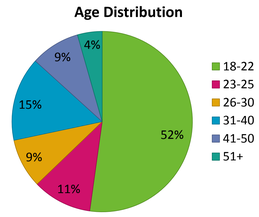
MERLOT Multimedia Educational Resource for Learning and Online Teaching

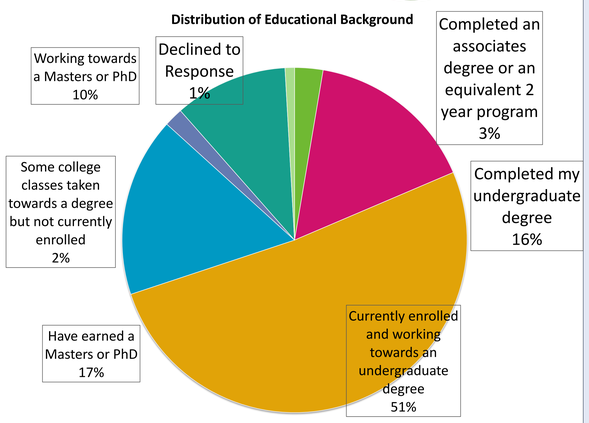
Population Demographics

- Gender:
  - Female - **82**
  - Male - **31**
- Age:
  - Between 18 and 25 years old - **71**
  - Over 25 years old - **42**
- Education:
  - Working toward or completed Post Baccalaureate- **33**
  - Non Post Baccalaureate Holders- **79**

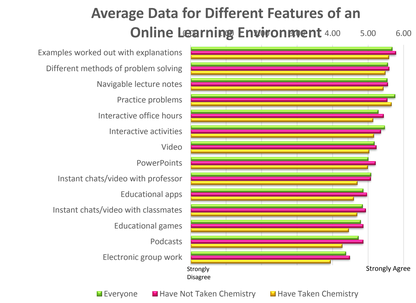








Results



ANOVA - Working Towards or Completed Post Baccalaureate /Non Post Baccalaureate Population and Tech Comfort

Dependent Variable: To what degree do you agree with the following statement? I am comfortable with adapting to (or learning to use) new technology.

	Sum of Squares	Degress of Freedom	Mean Square	F	Significance
Between Groups	3.429	1	3.429	3.263	0.074*
Within Groups	113.489	108	1.051		
Total	116.918	109			

* Approaching Significance

Conclusions

- Chemistry is FUN and we need to make learning it more engaging and approachable for students
- The incorporation of technology in education is viewed favorably
- Technology comfort is an important variable
- Larger sample size needs to be surveyed
- Approach and mindset are important when you begin to research a topic
- Survey question design needs to be specific
- Working with human subjects requires more attention to small details

Descriptive Statistics Without Tech Comfort Controlled

Technology and Education (IV)	Generation (IV)	Mean (DV)	Std. Deviation	Sample Size (N)
Electronic material and technology should be incorporated in to education.	*Younger*	5.30	.885	64
	Older	5.26	1.371	39
	Total	5.28*	1.088	103
Electronic material and technology should be incorporated into introductory chemistry education.	*Younger*	4.77	1.306	64
	Older	5.03	1.442	39
	Total	4.86*	1.358	103

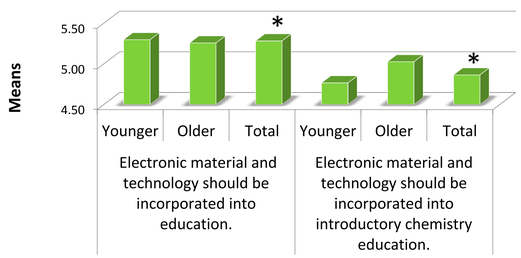
Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	TechnologyandEducation	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
TechnologyandEducation	Linear	7.036	1	7.036	16.748	.000	.142	16.748	.982
TechnologyandEducation * Generation	Linear	1.094	1	1.094	2.604	.110	.025	2.604	.359
Error (TechnologyandEducation)	Linear	42.430	101	.420					

a. Computed using alpha = .05

Technology and Education without Tech Comfort Controlled



Descriptive Statistics for Tech Comfort being Controlled

Technology and Education	Generation	Mean	Std. Deviation	Sample Size (N)
Electronic material and technology should be incorporated in to education.	*Younger*	5.29	.894	62
	Older	5.26	1.371	39
	Total	5.28	1.097	101
Electronic material and technology should be incorporated into introductory chemistry education.	*Younger*	4.76	1.314	62
	Older	5.03	1.442	39
	Total	4.86	1.364	101

Generation

Generation	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Younger	4.942*	0.097	4.75	5.135
Older	5.272*	0.122	5.028	5.515

*Statistically different, p=0.038

** Covariates appearing in the model are evaluated at the following values: To what degree do you agree with the following statement? I am comfortable with adapting to (or learning to use) new technology. = 5.42.

Tests of Between-Subjects Effects with Tech Comfort being Controlled

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[a]
Intercept	3.326	1	3.326	2.868	.094	.028	2.868	.389
Technology Comfort Level	148.710	1	148.710	128.215	.000	.567	128.215	1.000
Generation	5.123	1	5.123	4.417	.038	.043	4.417	.548
Error	113.666	98	1.160					

a. Computed using alpha = .05

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Acknowledgements

Thanks very much to:
Dr. Nicholas E. Grossoehme
McNair Program and Staff
Dr. Matthew Hayes and Ms. Cayla Eagon
Fellow Scholars and Lab Mates
Winthrop University Chemistry Department