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Scalable, web-delivered supports to help students "Learn to Learn"

Matthew L. Bernacki
University of Nevada, Las Vegas, matt.bernacki@unlv.edu

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PROJECT OVERVIEW: Learning Theory and Analytics as Guides to Improve Undergraduate STEM Education (Learning TAGs)

The Need

• Many graduate K-12 without skills necessary to manage learning (ACT, 2008)
• Incoming STEM majors typically fail to complete a STEM degree; more pronounced trend in underrepresented populations (Eagen, Hurtado & Chen, 2006)
• 6-year completion rate:
  - All STEM majors: 36%
  - From underrepresented groups: 29%
• Primary reasons for leaving STEM include perceived lack of skills to perform critical STEM tasks, lack of motivation to continue with training

The Project

• Learning management systems (LMSs) are ubiquitous in higher education, provide a platform for scalable, web-delivered support
• Learning sciences provide insight about ways learning skills can be built and motivation can be supported
• LMSs + Learning Theory + Analytics provide an opportunity to
  1. Provide resources to students
  2. Teach students how to use resources effectively The Science of Learning to Learn (below)
  3. Observe & adaptively respond to student learning data
    - Capture learning behaviors using log files
    - Develop prediction models that accurately identify students likely to struggle, obtain poor grades
    - Provide adaptive, personalized feedback to students via the LMS, directing resources to those likely to struggle

THE SCIENCE OF LEARNING TO LEARN

• Web-delivered set of training modules delivered via LMS
• Embedded in students’ course site, teach students (in 30-45 min per module):
  1. cognitive strategies known to improve learning outcomes
  2. methods of managing their learning process
  3. methods of managing self, behaviors, & one’s environment
• Instructional methods aligned to research on learning (Table 1)
• Ongoing trace data on student learning behaviors collected from University servers using Splunk application, performance data from LMS gradebook

Module 1: Introduction & Learning Principles

Opening Vignette: Emily the struggling student

- In this week, students are introduced to the principles of learning and the data that support effective strategies
- Students learn about the importance of self-regulated learning and the role of metacognition

Instructional Design of Science of Learning to Learn Modules

Table 1

<table>
<thead>
<tr>
<th>Instructional Design of Science of Learning to Learn Modules</th>
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</thead>
<tbody>
<tr>
<td>Brief explanation of the learning principle + assessment of learning with feedback</td>
</tr>
<tr>
<td>Description of studies showing practical effect on performance in a college course</td>
</tr>
<tr>
<td>Worked example illustrating how to use the learning principle in a STEM course</td>
</tr>
<tr>
<td>Vignette where learning principle is applicable, opportunity to advise a protagonist</td>
</tr>
<tr>
<td>Prompt to evaluate course resources that afford use of the learning principle</td>
</tr>
<tr>
<td>Prompt to develop a specific plan how to use the learning principle in the course</td>
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</tbody>
</table>

Module 2: Planning, Organizing & Monitoring Learning

Training in self-regulated learning

Assess their course’s learning objectives

Plan study: set goals & subgoals, enact strategies

Make efficient use of study time, avoid pitfalls

- Time management techniques to help students make the most of their study time
- Strategies for avoiding common study pitfalls

Module 3: Regulating Behavior & Environment

Training to help students

Make implementation intentions

Engage in mental contrasting

Regulate their environment to avoid distraction

- Techniques for managing self-regulated learning in group settings
- Strategies for managing stress and avoiding distractions

RESULTS & FUTURE DIRECTIONS

• Learning to Learn training had a demonstrable impact on biology students’ (N = 205) learning behavior & achievement in a lecture course

- Students in the training group showed significant improvement in exam scores compared to the control group

- Students in the training group reported increased motivation and confidence in their learning abilities

- The training targeted struggling students, as identified by their performance earlier in the course

- The training was delivered via the LMS, facilitating easy access and integration into students’ coursework

- A student’s likelihood of earning a desirable (B or Better) grade is increased by 15% compared to the control group

- The training benefits struggling students, burdens others

- NEW CHALLENGE: 1) identify students who need help
  - 2) deliver timely help to them

- A pilot project (underway) targets training to students in need.