Affordable Solutions using Adaptive Learning in General Chemistry II (CHEM-216)
Larry Mink, Andreas Beyersdorf, Jonathan Brooks
Department of Chemistry & Biochemistry
California State University San Bernardino
lmink@csusb.edu

**Affordable Learning**
Recent Adoption by CSUSB Chemistry:
1) Openstax College Chemistry Textbook:
   • Adopted in 2016 for general chemistry sequence (CHEM-215/CHEM-216)
   • Estimated saving for students of $140,000 annually (assumes 560 students per year & a textbook cost of $250)
2) Sapling Learning on-line homework system. Student cost $30 per quarter.

CSU Course Redesign with Technology Grant (2017-2018):
• Implementation of Adaptive Learning using Smart Sparrow platform, student cost $14 per year.
• http://courseredesign.csuprojects.org/wp/eportfolio/
• Cool4Ed. California Open Online Library for Education: http://cool4ed.org/

**Adaptive Learning**
Adaptive learning provides personalized teaching by using data-driven algorithms to tailor course content to student needs.

Goals:
1) The development of small weekly adaptive learning homework sets.
2) The capability for full faculty content editing.
3) The use of “open source” material.

In order to achieve these goals the Smart Sparrow Platform was chosen because of its fully customized content & ease of use for students.

**Modular Concept**
The goal of the lessons are to provide a unique experience based on the student’s capabilities.

Lessons are broken into modules that cover one topic covered in class. Each module includes:
1) High Level Question
   • If correct, they show mastery of that topic & move onto the next topic.
   • If incorrect, they move to a:
2) Mid-Level Question
   • If correct, they see a remediation video or text and then return to the High Level Question
   • If incorrect, they move to a:
3) Low Level Question
   • If correct, they see a remediation video or text and then return to the Mid-Level Question
   • If incorrect, they see a remediation video or text and then try the question again
   ➢ After two attempts on any question, the answer is shown.

An example question & remediation screen using an open source video.

**Implementation**
Student Beta-Testing in Winter 2018 helped develop content and trouble shoot. Some example feedback:
• With the adaptive learning you are also able to get pushed in the right direction with another related question.
• Although other online homework systems do offer hints or ideas to get you started on a problem, those hints are sometimes not enough to get you going on a problem if you are unsure where to begin.

Implementation in Spring 2018:
• Students perform 4 homework sets with Smart Sparrow & 5 with Sapling Learning.
• Current cost covered under CRT grant 2017-2018.

Assessment:
• Comparison of relevant homework & exam problems from current & previous CHEM-216 classes (pre-redesign) to Spring 2018 (post-redesign).
• Analysis of student grades and DFW rates.

**Future Goals**
1) Continue to design a pedagogically-sound adaptive learning algorithm that faculty from other disciplines can adopt.
2) Development of a complete series (10 per quarter) of weekly adaptive learning homework sets for students to go with the already adopted open source textbook. Implementation Winter 2019.
3) Create and curate quality video content tailored to the material covered in this course.
4) Produce and fully document an adaptive learning development blueprint for CSU Chemistry faculty.

**Funding**
➢ CSU Course Redesign with Technology Grant, 2015-2016
➢ CSU Course Redesign with Technology Grant, 2017-2018
➢ CSUSB Summer 2018 Innovative Course Development
➢ CSUSB Academic Technologies & Innovation (ATI)
➢ CSUSB Affordable Solutions Mini-Grant