Improved Student Success and Retention with Adaptive Courseware

An Arizona State University Case Study

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Introduction

In this case study we discuss the positive results of a recent Adaptive Courseware Pilot conducted at Arizona State University during the Fall term 2015. We provide a detailed overview over the planning and execution of adaptive courseware projects and present a range of dashboards and learning analytics that can be used to enhance interactions between instructors and students.

In partnership with CogBooks, an adaptive learning platform provider, two adaptive GenEd courses were developed at ASU. The introductory biology course, 'BIO 100', used a blended-learning approach while 'U.S. History Since 1865', History 110, was delivered as an online course. In Fall 2015, the number of enrolled students for BIO 100 and HST 110 were 527 and 25 respectively. The content for both of the courses was sourced from our content and media partner, OpenStax[1].

The ASU Courseware Pilot in cooperation with CogBooks is part of the Next Generation Courseware project funded by the Bill & Melinda Gates Foundation. The aim of this project is to help low-income and disadvantaged learners succeed in high-enrollment general education undergraduate college courses. A key component of the work is to personalize instruction using adaptive online learning technology.

CogBooks aims to deliver the full potential of technology-assisted learning, by combining the highest quality content and latest online adaptive learning technology with the best teaching staff and faculty. We design our courseware to support both teaching staff and students through the duration of a whole course. It acts as a replacement for the main textbook and provides additional capabilities beyond a simple digital text book or on-line resource. Our advanced adaptive personalization means that students come to class better and more equally prepared. Faculty and instructors enjoy a higher level of interaction with their students and a more rewarding teaching experience.

[1] https://openstaxcollege.org/

Implementation

Building the outcomes based course

Figure 1 Implementation process

At the beginning of this and every other adaptive project, the learning outcomes are defined by the instructor. Outcomes, i.e. what your students should know or be able to do by the end of the class, can be broken down into the overall program outcomes, sub-outcomes and then subject outcomes. This approach is based on research related to transformational outcomes-based education (Davis, 2003; Spady & Marshall, 1991).

As an example, the BIO100 program outcome is described as follows:

"*Have a better understanding of what aspects of learning can best be done in class or at home, the benefits of applying the scientific method, basic probability and mathematical proportions to everyday decisions as well as the lab. On top of that, students will be able to distinguish the benefits and costs of learned behavior and instinct and the impact of political and anecdotal arguments as compared to evidence based medical arguments.*"

Learning outcomes are defined in CogBooks and the relationships between them are represented in a Learning Outcome map. In parallel, Learning Activities are created and the relationships between these Activities are captured in a Learning Map. Learning Activities can either be concept pages (text, images, audio or video), tests (MCQ, MR etc.) or containers (containing multi-part or sequential learning activities). Once these two maps are developed, learning activities are then associated with their Learning Outcomes.

The maps also provide the basis for the further development of the course. To build the course, the instructor defines a default learning path (through the learning map) that acts as the starting point for each student. The default path is targeted at the 'typical' student within the target audience. Once the course is underway, CogBooks will personalize each student's learning journey based on their behavior.

The instructor takes a lead on creating the Outcomes and Learning Maps, and Instructional Designers provide support and advice along the way. During the course development, a team comprised of developers, instructional designers and the instructor will constantly undergo content, technical and design QAs to ensure the quality of the course. Depending on the scope of the course content this process can take from 6 weeks to up to 4 months. At ASU, the courses were developed within 3 months.

After the release of the course, instructors are provided with and trained in using smart authoring tools that will allow them to change and customize the course for future terms.

Flipped classroom model

BIO 100 was built as a flipped classroom course. Students completed their lessons in CogBooks before they came to class and completed applied concept exercises in small groups during class. This learning cycle, leaning on Kolb's (1984) learning cycle, ensures that students gain a deep understanding of the material.

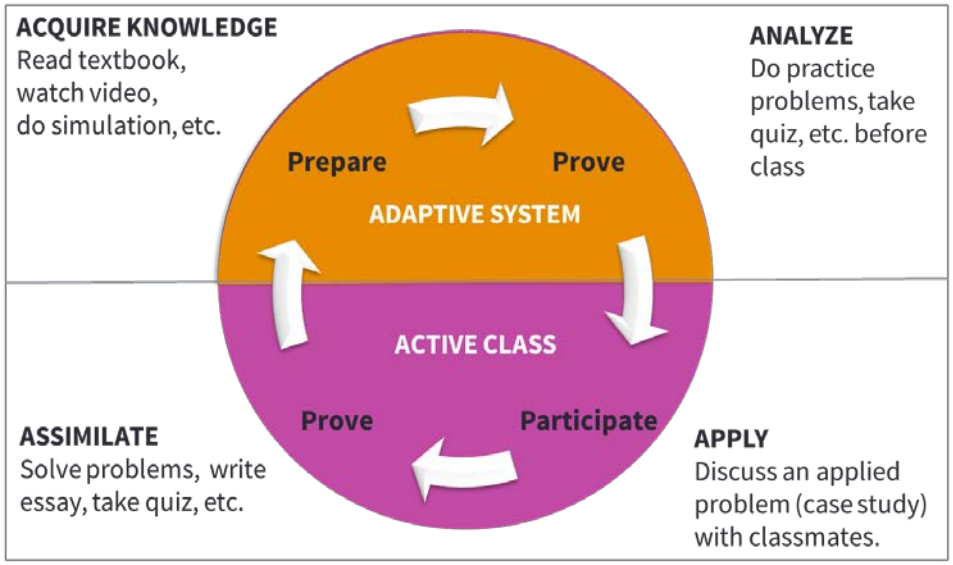

Figure 2 Flipped learning approach at ASU BIO 100

Results

Student Survey

Figures 3 and 4 show the results of an online survey conducted among the BIO 100 and HST 110 students (n=60) at the end of the spring term 2016.

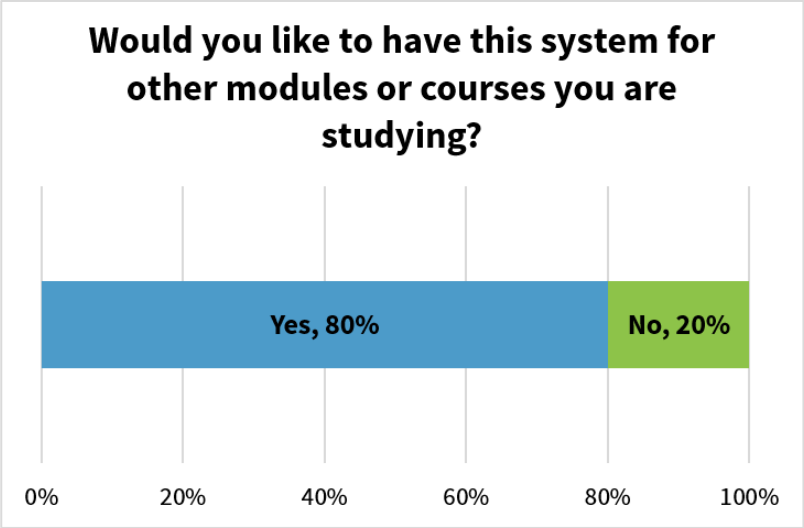

Figure 3 Results of online student survey (n=37)

80% of students surveyed would like CogBooks used in other modules or courses that they are studying. In a focus group conducted separately from this online survey, students indicated that it would be useful across a variety of subjects, e.g. sociology, sciences, math or business.

Some quotes from the focus group:

"Throughout the semester, I believe CogBooks has been a great method for learning history. Though, I don't know if it would be the same feeling for math or other science courses, but I would be willing to try that out."

"I would say CogBooks is a fun way to learn history."

"Through my years in school, history has always been a tough subject. Historical events were difficult for me to grasp because it was hard for me to imagine something that happened years ago, I never felt that my knowledge was at its full potential when I read page after page of an old

textbook. After a while, I would lose concentration and didn't know what I was reading about. The CogBooks software, however, completely changed the way I absorbed the information."

"While completing this course, I found CogBooks very simple and straightforward. It was easy to read and learn from it. I found the check your understanding parts very helpful in preparing me for the quizzes given by the teacher. It allowed me to learn the objectives from each section. I would use it again for another course."

"Overall, I would definitely sign up for another class that used CogBooks."

"I am currently finishing my senior year here at ASU and when I graduate I will be searching for a teaching job and I'm hoping it is for American History. I can honestly say, that I wish I had access to CogBooks as a teacher. I think it scaffolds work very well from the beginning to the end of the course. It provides all level of students with the opportunity to learn and test themselves."

"I really enjoyed being a part of the CogBooks experience. It was really cool to be able to come back to the material at my own pace, when I had a free moment set aside for it, and how easy it was. The readings were easy to understand, almost conversational. For once I didn't feel dumb in a history class."

"In the future I hope to take more online classes with CogBooks because I think it really is a great way to learn and take online classes."

"I have enjoyed working with the CogBooks' history course, and believe it will be a great transformation to the Arizona State University learning environment."

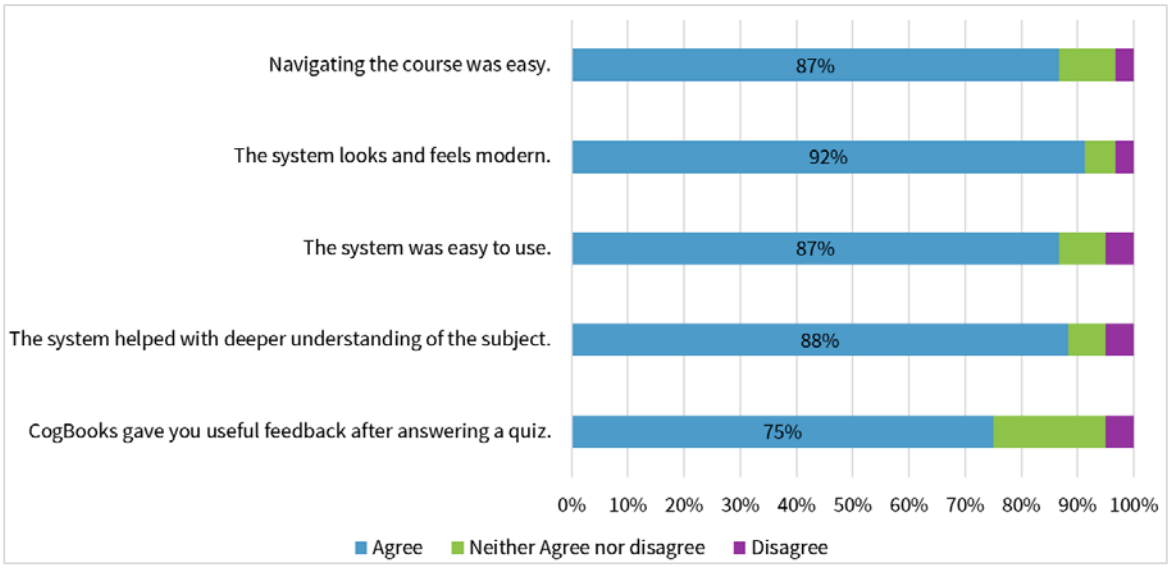

Figure 4 Results of online survey (n=60)

The results of the online survey and the focus group show that the majority of students were extremely satisfied with the courseware and confirmed that it is an easy and effective way of learning.

BIO 100 Course Grade Performance

Figure 5, 6 and 7 summarize the improved end of term results in the fall term 2015 as compared to previous terms in 2014 and 2015. Due to the introduction of CogBooks as a teaching tool the success rate, or cumulative percentage of A-, B- and C-grades, was improved by 3.4 pp across all instructors using the same curriculum and assessment. Furthermore, the final GPA improved by 8% (0.21) whereas the dropout rate decreased by 2pp.

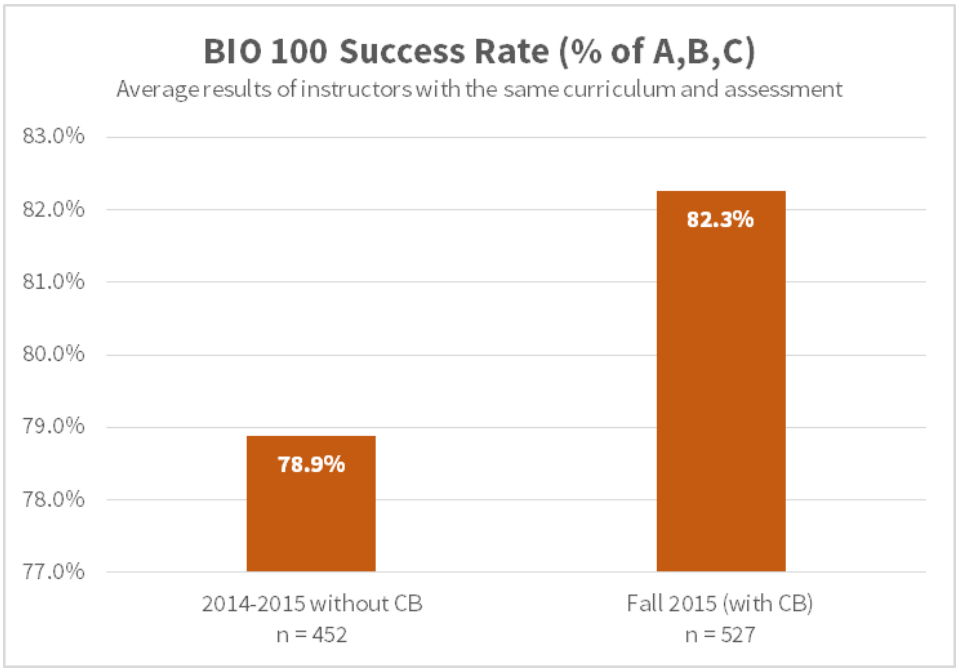

Figure 5 Success Rate in BIO100

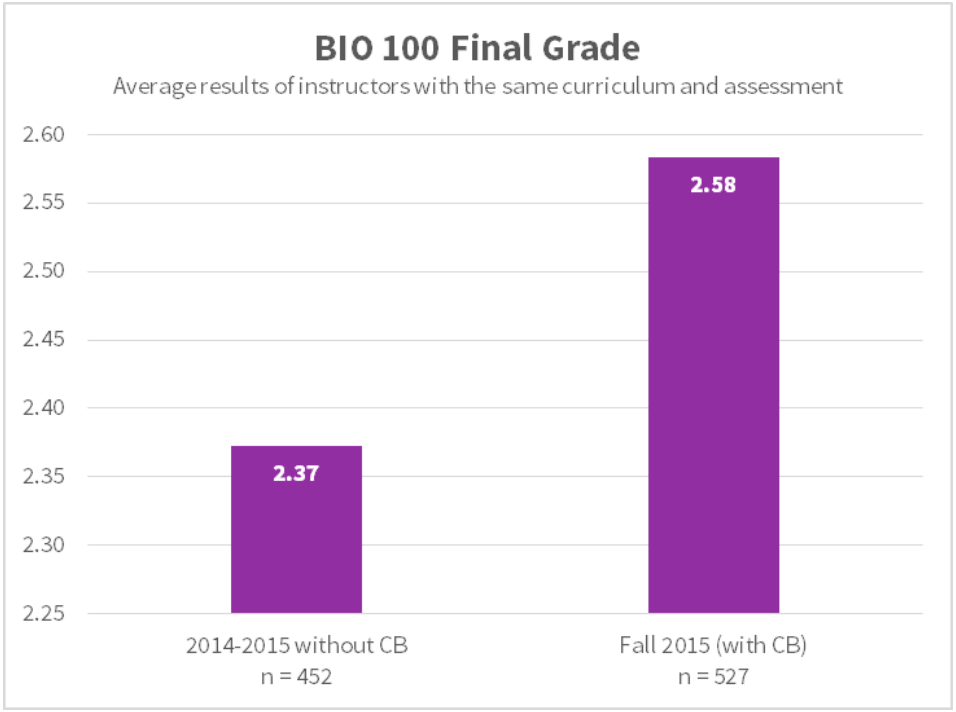

Figure 6 Final Grades in BIO 100

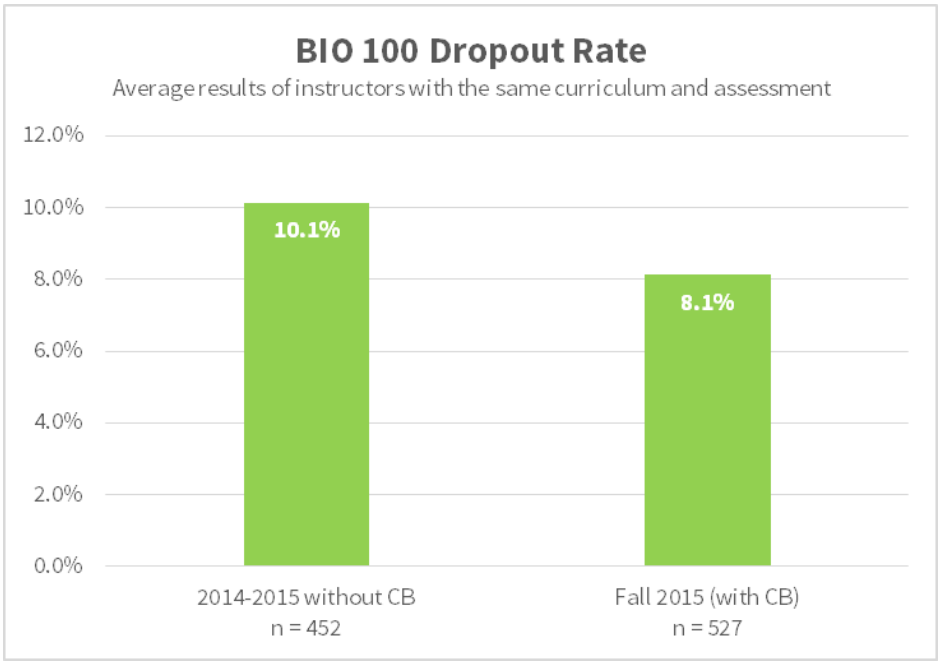

Figure 7 Dropout Rate in BIO 100

Removing results from new instructors that had not taught this course previously, there is an even more substantial improvement in Success Rate (18 pp increase) and Dropout Rate (13 pp decrease). New instructors typically begin with slightly lower grades in the first one to two years before reaching a stable level of grade performance.

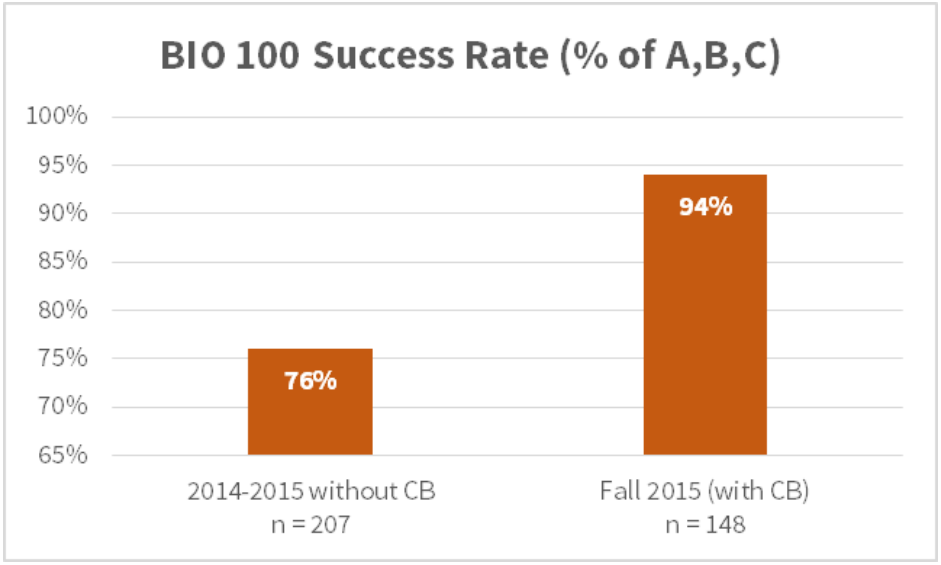

Figure 8 Success Rate of most experienced instructor

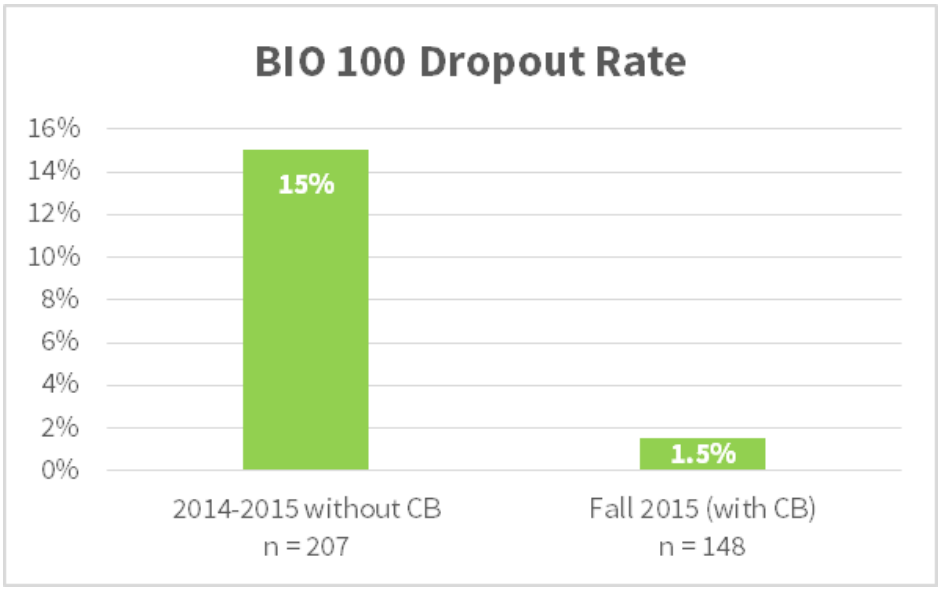

Figure 9 Success Rate and Dropout Rate of most experienced instructor

This highlights the significant improvement that adaptive courseware can make if utilized appropriately. It is likely that the more online/blended teaching training and experience instructors gain the bigger are the improvements of their students.

Know your students

CogBooks provides several different dashboards that give instructors unprecedented insight into the progress and challenges of their students. The dashboards help instructors to identify the students who need further support and gives them a detailed understanding of the specific problem areas they have. Moreover, rich learning analytics show instructors which learning activities work for the students and which don't. This functionality is an extremely powerful tool to trigger goal-focused discussions between instructors and students. It allows the instructor to quickly see how students are performing in real-time without having to wait for mid or end of term results.

Module Progress Reports:

- Class/Section Module Completion Status: At a module level, shows the percentage of students in the class who have completed the individual modules in a course.
- Student's Module Completion Progress: Within a module, shows the student's module completion percentage and maps it to the student's completion of individual learning activities.

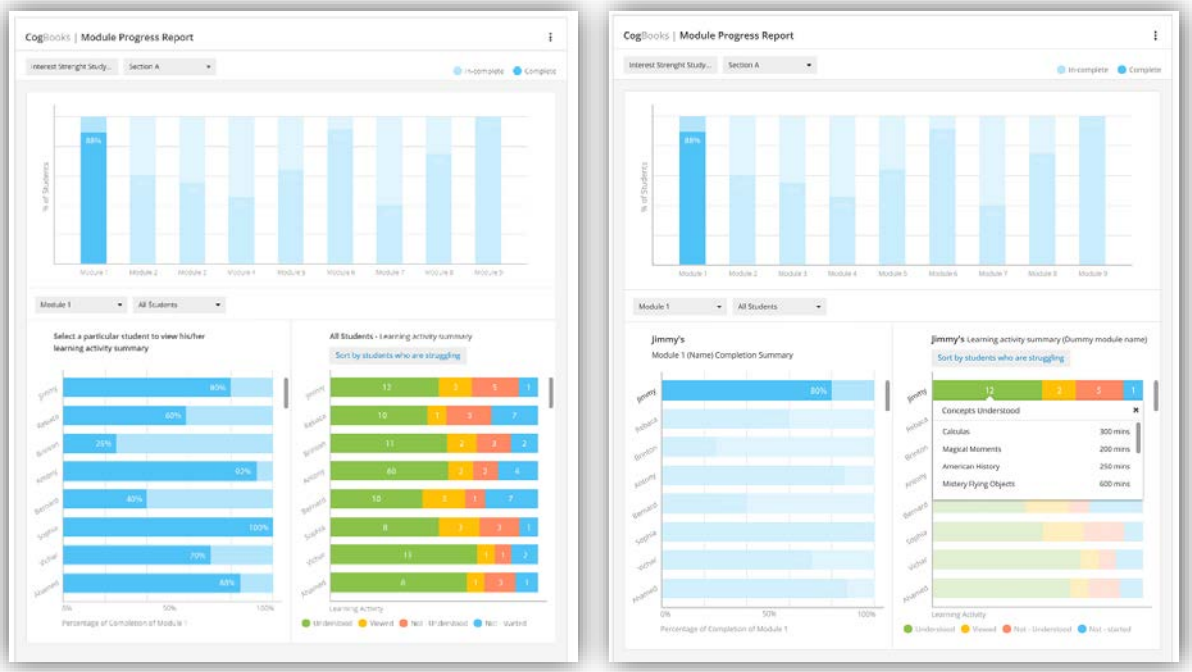

Figure 10 Module Progress Report

Assessment Health Check Reports:

- Class/Section Assessment Completion Status: At a module level, shows the percentage of students in the class who have passed, failed, not-started & skipped assessments.
- Students Assessment Completion Progress: Within a module, displays student assessment completion progress for all the assessments in a course – whether the student has passed/failed/skipped/not viewed an assessment.
- Student's Question Completion Progress: Within an assessment, displays individual student question completion status – whether the student has answered the questions correctly/incorrectly/not viewed. Also compares the individual student's performance in an assessment with the rest of the class/section.

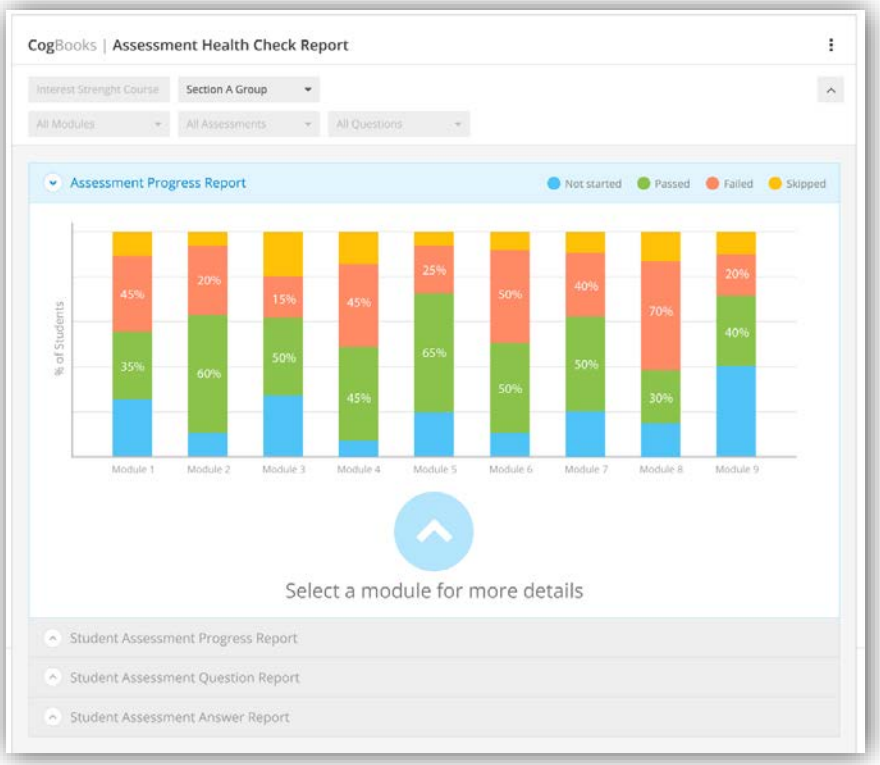

Figure 11 Assessment Progress Report

Student's Answer report: Within a question, displays individual student answer details broken down to various attempts, with the date and time of each attempt. Also compares individual student answers with the rest of the class/section.

First Attempt Report: Displays the answers submitted by the students in their first attempt of an assessment.

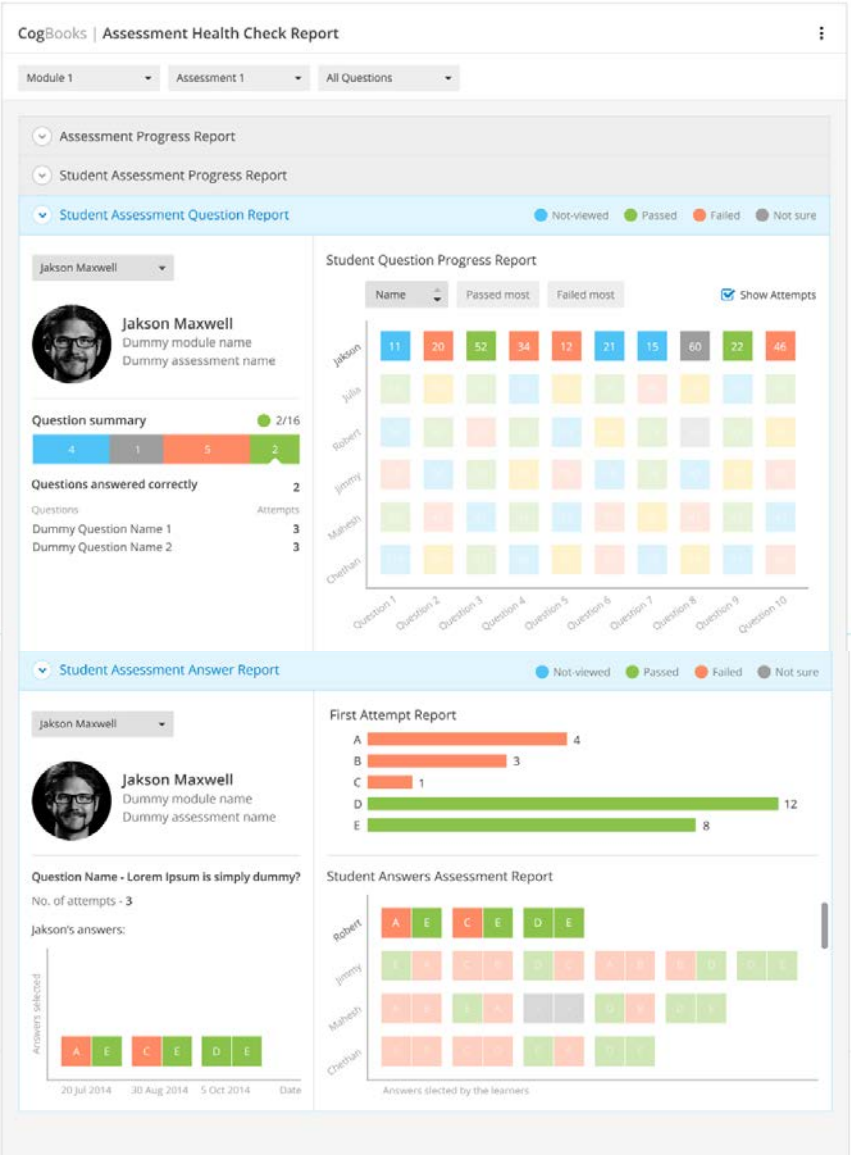

Figure 12 Student Assessment Progress Report

Performance Dashboard:

- Group Progress: Within a module or a sub-module, displays an individual student's status against each learning activity – whether the student has completed/skipped/not started. If the learning activity is a test concept, the report displays the answers submitted by the student.
- Learner Path: Displays the specific path that a student followed and view the deviations or issues that they encountered along the way

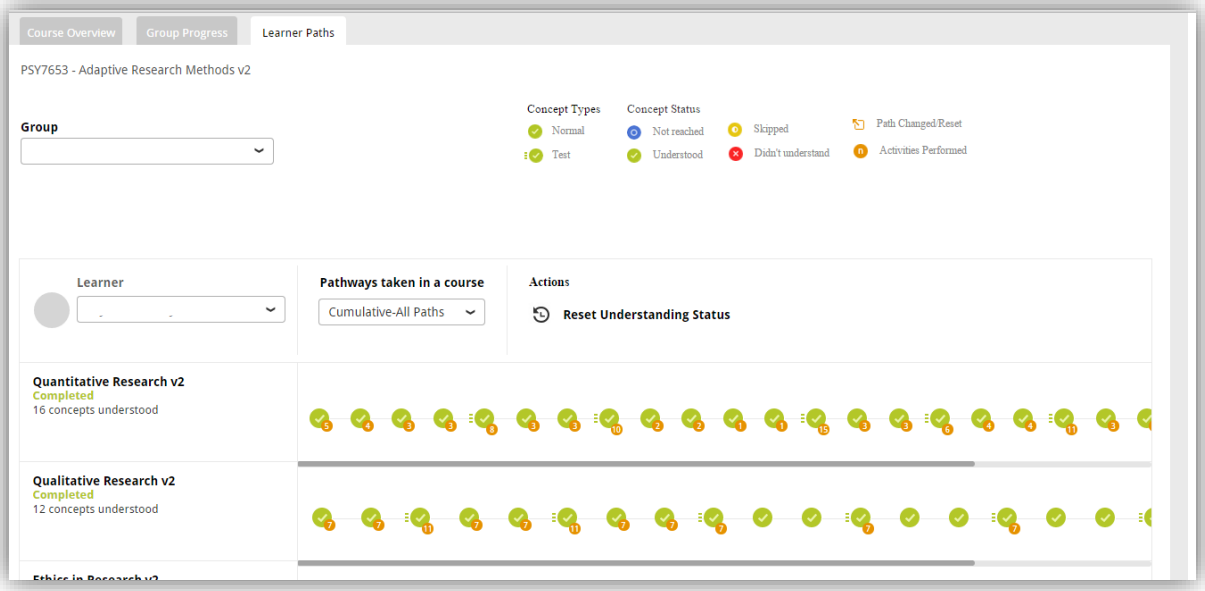

Figure 13 Learning Path Report

On-Demand Reports:

In addition to standard reporting, full learning analytics tools are also available. The following are samples of the kind of analysis possible:

- Engagement analysis: Allows instructors to see how much time students spend on each learning activity. This data can be used to decide which type of content (Text, video, audio etc.) engages students most.

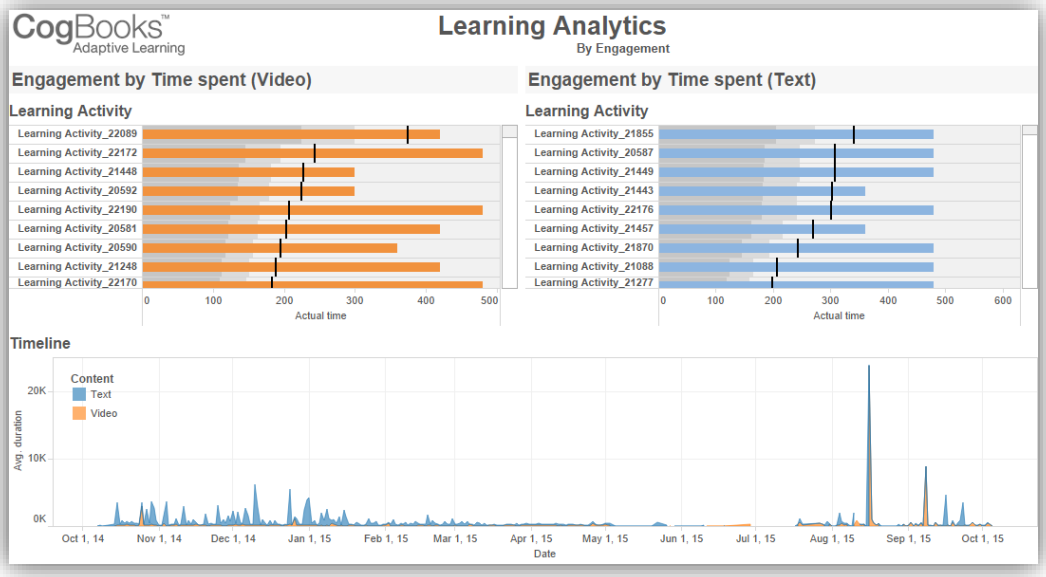

Figure 14 Engagement Analysis

- **Learning activity analysis:** This analysis illustrates the difference in students' learning activity between the students who answered the question correctly and those who answered it incorrectly.

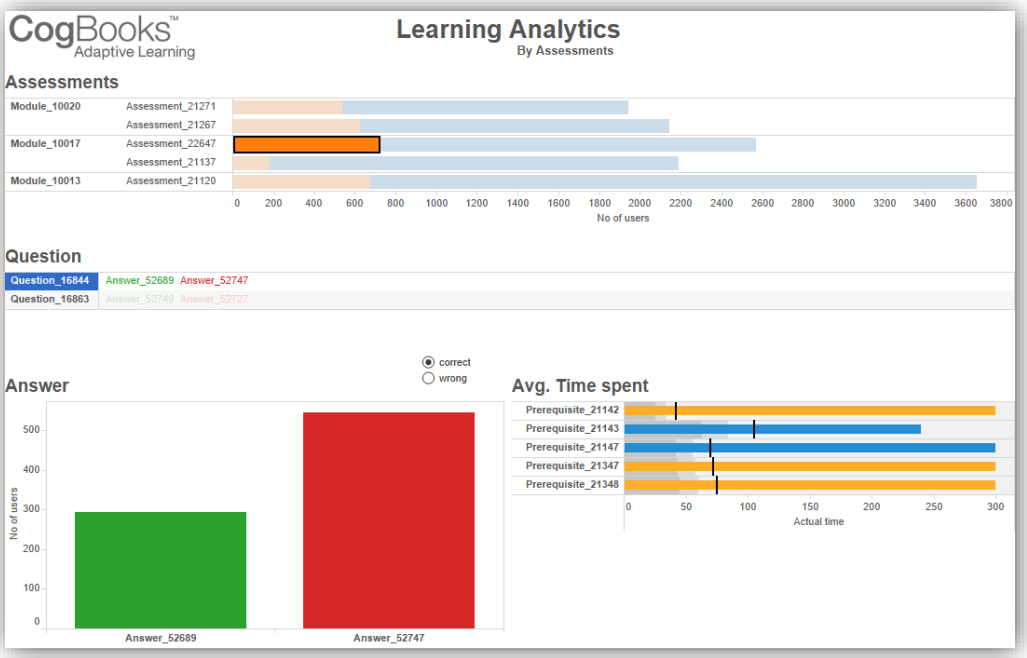

Figure 15 Learning Activity Analysis

- Usage Analytics: This analysis shows the instructor when students are most likely to actively work on the course and when they are usually offline, in case changes need to be made.

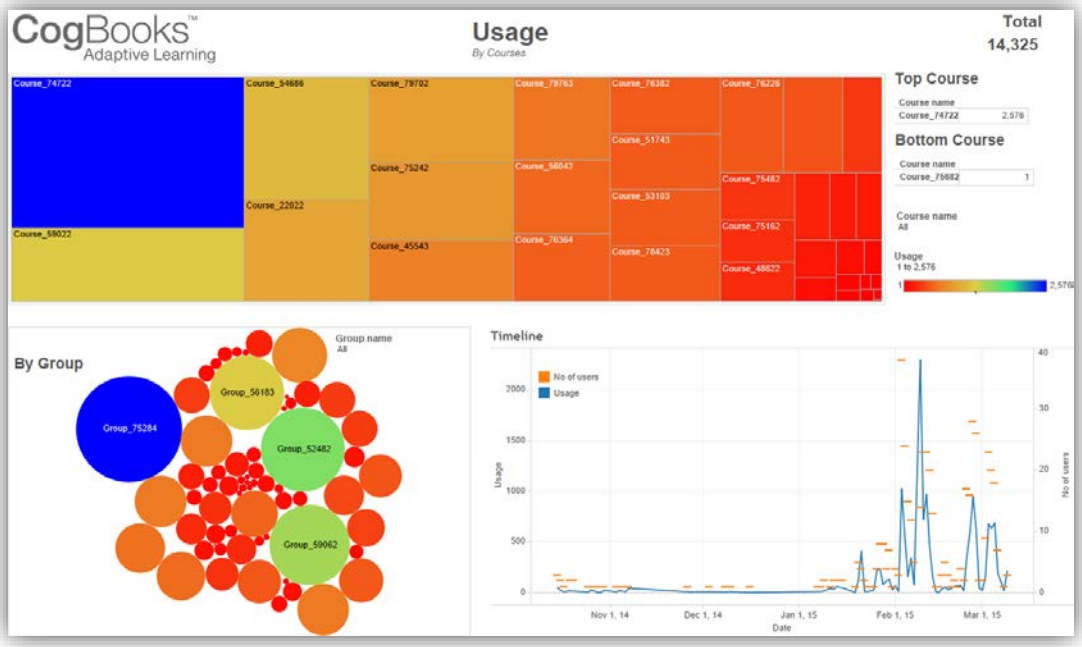

Figure 16 Usage Analysis

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