

A large, multi-story stone building with a prominent central clock tower, identified as the University of Toledo. The building features Gothic-style architecture with numerous windows and a grey slate roof. It is set against a clear blue sky with a few wispy clouds. In the foreground, there are green trees and a grassy lawn.

THE UNIVERSITY OF TOLEDO:

*Adaptive Courseware for Early
Success Case Study*

Authors

Riccardo Purita, M.Ed., Manager, Office of Digital Transformation for Student Success & the Personalized Learning Consortium at the Association of Public & Land-grant Universities

Megan Tesene, Ph.D., Assistant Vice President, Office of Digital Transformation for Student Success at the Association of Public and Land-grant Universities

The Association of Public and Land-grant Universities (APLU) is a research, policy, and advocacy organization dedicated to strengthening and advancing the work of public universities in the U.S., Canada, and Mexico. The association's membership consists more than 250 public research universities, land-grant institutions, state university systems, and affiliated organizations. APLU works with members to expand access and improve student success to deliver the innovative workforce of tomorrow; advance and promote research and discovery to improve society, foster economic growth, and address global challenges; and build healthy, prosperous, equitable, and vibrant communities locally and globally. The association's work is furthered by an active and effective advocacy arm that works with Congress and the administration as well as the media to advance federal policies that strengthen public universities and benefit the students they serve.

Every Learner Everywhere is a network of twelve partner organizations with expertise in evaluating, implementing, scaling, and measuring the efficacy of education technologies, curriculum and course design strategies, teaching practices, and support services that personalize instruction for students in blended and online learning environments. Our mission is to help institutions use new technology to innovate teaching and learning, with the ultimate goal of improving learning outcomes for Black, Latinx, and Indigenous students, poverty-affected students, and first-generation students. Our collaborative work aims to advance equity in higher education centers on the transformation of postsecondary teaching and learning. We build capacity in colleges and universities to improve student outcomes with digital learning through direct technical assistance, timely resources and toolkits, and ongoing analysis of institution practices and market trends. For more information about Every Learner Everywhere and its collaborative approach to equitize higher education through digital learning, visit everylearnereverywhere.org.



The University of Toledo (UToledo) prioritized community building and extensive faculty professional development in the areas of course design, pedagogy, and applications of adaptive courseware to guide faculty from three academic departments to redesign introductory courses leveraging adaptive courseware products.

ADAPTIVE COURSEWARE FOR EARLY SUCCESS INITIATIVE

The Adaptive Courseware for Early Success (ACES) Initiative was a grant-funded initiative supported through the Every Learner Everywhere network and funded by the Bill and Melinda Gates Foundation. In total, thirteen colleges and universities from Ohio, Texas, and Florida participated in this initiative from 2019 through 2021. Six 4-year universities, which are members of the Association of Public Land-grant Universities (APLU) received direct guidance and support from the Personalized Learning Consortium (PLC), located in the Office of Digital Transformation for Student Success (DTSS). The ACES Initiative centered around two primary goals:

- To redesign critical gateway courses taught by faculty committed to integrating equity-centered, evidence-based teaching practices that are enhanced by adaptive courseware
- To create more equitable student outcomes by improving learning and educational experiences for poverty-impacted students, racially minoritized students, and first-generation students

Over the course of two and a half years, the PLC provided intensive coaching, peer-mentorship, collaborative learning and networking opportunities, and educational resources and training to cross-functional, institutional teams at select institutions. These institutions received further support and benefits from the Every Learner network partners, including Achieving the Dream and Digital Promise who offered collaborative learning with participating two-year institutions and program evaluation support, respectively.

Note. It is critical to acknowledge that this initiative took place at the onset and height of the COVID-19 global pandemic crisis. The COVID pandemic dramatically altered the higher education landscape in 2020, requiring colleges and universities to rapidly transition to remote instruction and to reprioritize the allocation of their resources and institutional capacities to appropriately respond to the crisis. Despite facing these challenges, each of the participating institutions carried on their work, adapting in real-time and focusing on how to best leverage newly adopted technologies and supporting students with quality teaching practices. For more information on the impact of COVID on these grantees and other institutions, please see our network partner Digital Promise's report, *Suddenly Online: A National Survey of Undergraduates During the COVID-19 Pandemic*.

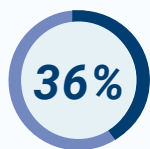


The University of Toledo Demographics

12,000 undergraduate students and **3,600** graduate students

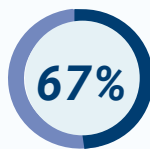


4-year public research institution in Toledo, Ohio



36%

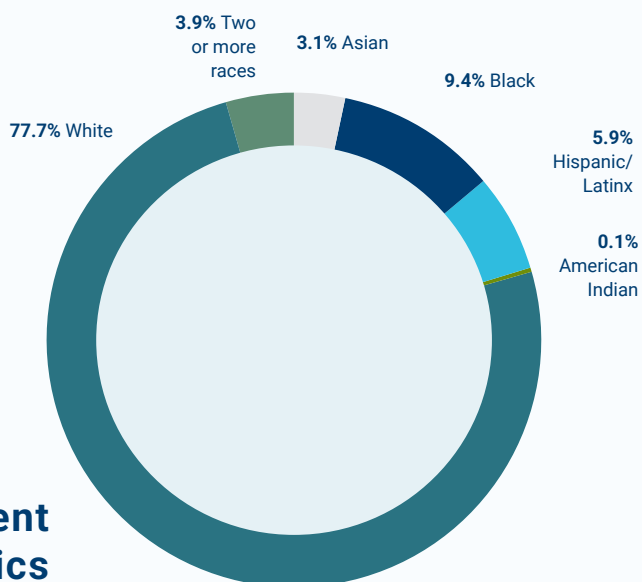
of undergraduate students are eligible for a Pell Grant.



67%

As of fall 2020,

of undergraduate students were enrolled in at least one online course, with **14% enrolled exclusively online.**



Student Demographics

Institutional Background

UToledo has a history of being involved in collaborative efforts to improve student success by focusing on enriching students' experiences in the classroom. In 2017, the University of Toledo developed a 5-year strategic plan focused on improving student success (The University of Toledo, 2017). As part of this plan, the institution revised incoming students' first year into a formalized experience program. This process included an effort to increase completion of gateway courses by integrating adaptive courseware and evidence-based instruction practices such as active learning. UToledo is also a member of the Student Experience Project (SEP), an APLU-supported program led by the Coalition of Urban Serving Universities (USU), with funding from the Raikes Foundation. The project brings together institutional leaders, faculty, researchers, and higher education organizations to focus on improving college degree attainment by identifying and applying high-impact, evidence-based instructional practices (Student Experience Project, 2021).

Participating in the ACES Initiative provided UToledo with an opportunity to expand these efforts, support existing applications of adaptive courseware, and reach new disciplines. UToledo's College of Natural Sciences and Mathematics was already using adaptive courseware (ALEKS [Assessment and Learning in Knowledge Spaces] hosted by McGraw Hill) in its first-year math gateway courses, as part of Ohio's Strong Start to Finish initiative. The college also used ALEKS for placement testing, and homework in first-year introductory and general chemistry courses. Therefore, chemistry and mathematics gateway courses were chosen to build on those departments' familiarity with adaptive learning. Anatomy and physiology courses from the College of Health and Human Services were also chosen for the ACES Initiative because these gateway classes had high enrollment and high drop, fail, withdrawal (DFW) rates (in some sections as high as 40 percent) which contributed to lower retention rates.

Goals of Grant Participation

UToledo was already working toward improving outcomes in gateway courses through a redesign of the first-year experience. The institution outlined goals to increase the retention of students from underrepresented populations through its Strategic Plan for Diversity, Equity, and Inclusion (University of Toledo, 2020). Research has found that Black, Latinx, and Indigenous college students are less likely to obtain a STEM (science, technology, engineering, mathematics) degree after receiving a grade of "D" or lower in a gateway STEM course compared to White students, even after controlling for intent and academic preparation (Hatfield et al., 2022). UToledo hoped to strengthen its existing efforts to integrate adaptive courseware into math and chemistry gateway courses, while also increasing retention rates for students in anatomy and physiology gateway classes. Through the ACES Initiative, UToledo hoped to:

- learn about and apply lessons from other institutions' experiences of adaptive courseware applications that had effectively supported student success, especially for students from underrepresented populations;
- increase implementation of adaptive learning software in anatomy and physiology courses;
- increase use of adaptive learning software to create more class time for high-impact, active learning;
- reduce the number of non-productive credit hours that cost students both time and money.

Planning for Implementation with Faculty Professional Development

UToledo coordinated faculty professional development and teaching support throughout the design and implementation of the initiative. Experts at APLU and other higher education–supporting organizations contend that faculty integrating adaptive courseware must be sufficiently trained and resourced through a collaborative and distributed model at their institutions (Holiday et al., 2020). UToledo provided its participating faculty with multiple professional development and collaborative learning opportunities throughout the initiative. Of note is the university’s Course Design Institute (CDI), which it leveraged in the summer of 2019. The CDI is an existing annual, voluntary workshop for faculty members put on by the Center for Excellence in Teaching and Learning. UToledo was able to successfully leverage this existing campus resource and tailor it to the needs of faculty participating in the ACES Initiative.

The summer 2019 CDI was an intensive instructional training requirement for all UToledo faculty members involved in the implementation process. The 5-day training focused on different aspects of integrating adaptive courseware into their classes, including designing assignments and evaluations, organizing course content and learning activities, and discussing teaching and learning practices like backward design. Within this specialized CDI, UToledo requested that APLU provide additional support for participating faculty on the use of adaptive courseware in redesigned courses. APLU brought an exemplary faculty member from the University of Kentucky to the UToledo campus to showcase her experience and knowledge in active learning and use of educational technologies to promote student engagement. The UToledo team was also very interested in understanding how to use student data from the adaptive courseware to inform its pedagogical practices. An institutional faculty exemplar who was highly skilled at identifying, pulling, and using student-level data to inform her teaching practices was also invited to the CDI to share effective strategies with the other faculty members.

As an additional professional development and networking resource, APLU provided access to faculty learning communities in which participating grant faculty could engage in pedagogical training with faculty peers from other institutions who were a part of the ACES Initiative. Trained facilitators with experience in adaptive learning guided faculty members on building critical reflection skills to enhance their teaching practices. By providing an array of professional learning opportunities, the UToledo team elevated the importance of quality instruction and course design in their faculty’s courseware integration efforts.



Course Implementation

Mathematics

Mathematics faculty used the adaptive product, ALEKS hosted by McGraw Hill, for one gateway course (Table 1). Trigonometry had not yet been fully integrated with adaptive courseware, unlike several other math courses, so it was chosen for this initiative.

Chemistry

Chemistry faculty used the adaptive product, ALEKS hosted by McGraw Hill, for three gateway courses (Table 1). ALEKS, in conjunction with other engagement tools like Turning Point, was used to connect with students in-person and virtually. The adaptive product also provided dashboard analytics on student learning, which faculty tried to integrate into future lectures. After the transition to remote learning in spring 2020, General Chemistry I instructors also used ALEKS to administer one of the course exams. Participating faculty members worked as a team to integrate adaptive courseware across the sections.

Anatomy and Physiology

The anatomy and physiology faculty delayed the integration of adaptive courseware until spring 2020 to decide on a product to use. The adaptive product, Learnsmart Connect hosted by McGraw Hill, was used for the lab sections of two gateway courses (Table 1). The product provided simulated lab experiences for students to prepare before class.



Table 1.*Course Implementation of Adaptive Products*

Discipline	Course Name	Adaptive Product	Students	Faculty
Anatomy and Physiology	Anatomy and Physiology I	Learnsmart Connect (McGraw Hill)	199	1
	Anatomy and Physiology II	Learnsmart Connect (McGraw Hill)	234	2
Chemistry	Elementary Chemistry	ALEKS (McGraw Hill)	1089	2
	General Chemistry I	ALEKS (McGraw Hill)	2247	4
	General Chemistry II	ALEKS (McGraw Hill)	169	1
Mathematics	Trigonometry	ALEKS (McGraw Hill)	798	4
Totals	6	2	4,736	10 (with some faculty teaching across multiple courses)

Note: Final data as reported by the university in fall 2019, spring 2020, summer 2020, fall 2020, and spring 2021.

Implementation Challenges

The transition to fully online learning in spring 2020, caused by the COVID-19 pandemic, forced UToledo to change its course structure and assessment practices. In addition, the institution faced budgetary cuts that led to the original project lead stepping away from the institution. This in turn led to a change in project leadership: an exemplary faculty member who was already part of the initiative and implementation stepped into that leadership role. Informed by its work on an array of student success and institutional transformation initiatives, leadership from DTSS recommends that, from the start, institutions build knowledge and capacity across their teams, with integrated and collaborative support woven into the design and implementation of projects to ensure success (Vignare et al., 2023). By tapping an experienced faculty lead to transition into the role of project leader, UToledo was able to carry the project forward as planned.

Resources and Time Commitment

Faculty members devoted many hours to redesigning the courses for adaptive courseware implementation. A few of them joined the faculty learning communities to collaborate on the process, but at least one dropped out due to the time commitment. Because the anatomy and physiology faculty had not previously used adaptive products in its courses, they needed to spend additional time deciding on which product to use. Additionally, they did not have experience with adaptive courseware, which increased the learning required and limited the implementation to one section of Anatomy and Physiology II. An undergraduate learning assistant was added to provide technical support during synchronous, remote lectures and help pull data analytics reports from the adaptive product.

Similarly, even though the mathematics department had extensive experience with adaptive courseware, it did not implement the fully revised Trigonometry materials in the first semester because a teaching assistant was not hired in time. Multiple institutions involved in the ACES Initiative have utilized learning or teaching assistants to support faculty members in their use of data and targeted personalized instruction for students.

In addition to the time needed to implement the adaptive courseware, it also took multiple semesters for the faculty members to adjust their teaching to the new course design. When implementing new educational technology, it takes time for strategic change to occur (Roberts, 2008). Instructors needed time to learn how to use the product's features to inform student needs. The faculty members who used ALEKS in their courses were unsure how to incorporate the dashboard analytics into their teaching until later in the implementation process. It also took time to align the courses' textbooks with the courseware. While the change led to less time being spent on grading, more time was needed to review the student data. Therefore, multiple resources were required to fully implement the adaptive products.

Impact of Adaptive Learning Implementation

Faculty Professional Growth.

Project Lead Barbara Schneider expressed that the biggest institutional benefit from the implementation process was *"increased faculty development and a much deeper awareness of our equity gaps and our ability to address them."* Faculty development included improved teaching practices and cultural changes within departments. Some faculty members reported that they became more aware of available student outcome data and were more likely to use analytics from the adaptive products to inform their teaching practices. This finding was consistent with the initiative's broader impact on instructors across the ACES Initiative (Digital Promise, 2022).

One faculty member referred to this positive impact as *"professional growth". Having a better understanding of what students are going through and being able to adjust accordingly. Becoming more open minded.* This professional growth was especially helpful for newer faculty members who *"found this project beneficial to their teaching pedagogy."*

Two faculty members greatly expanded their use of diverse teaching methods to cater to student needs:

“ *[One faculty member] has worked hard to make Blackboard quizzes more adaptive, offering some unlimited quizzing that encourages students to keep trying to learn the material. She has also increased her monitoring of student progress, her communication with students, and flexibility in deadlines. Additionally, she included more active learning (answering ‘clicker’ questions) within the course of the class, rather than waiting until the end. [The other faculty member] has pursued the idea of different homework sets for students with different levels of competency.”*

The ACES Initiative has also led to cultural changes within departments because of the need for further collaboration. Another faculty member stated that *“when all faculty had to rely on those that had experience with the technology, I think it helped bring the department closer. We had to rely on each other’s support more.”* Faculty in the Chemistry department noted that the ACES Initiative had caused them to be *“more open to innovation and change in our teaching.”* Being part of this process increased communication between colleagues and *“helped build a community of faculty.”* Faculty learning communities are an effective professional learning and engagement strategy that can support faculty members as they learn new or refine existing skills (Adams et al., 2023; Hoke et al., 2021). APLU leadership recommends that institutions provide space and resources to faculty members, where possible, so that they may engage with a community of their peers as they participate in teaching and learning initiatives focused on student success, as this has been shown to be the most effective in changing practices (Vignare et al., 2023).

Student Improvements.

The anatomy and physiology faculty members felt that the adaptive courseware implementation led to a *“huge transformation.”* One instructor described how she would review the data from generated student reports and meet with students to discuss the information further. For example, she would see how much time students spent on concepts and offer feedback on ways to prepare better, like spending more time reading the material rather than focusing on the questions. This data-informed process enhanced student learning, as evidenced by UToledo’s team report:

“ *We feel the students are actually learning the content and not just memorizing and forgetting. By using the adaptive courseware, we are able to target student misconceptions early and fix them before it’s too late (after we see exam results). Student inquiries have improved from simple knowledge questions to more critical thinking and application.”*

Some students also expressed how the adaptive courseware aided their learning. One student discussed how “[McGraw Hill] definitely helped with the lab side really because it was a lot easier. I used it more because you could get visuals from it better.” Another student mentioned that they found ALEKS to be “very beneficial. I take notes when I get a problem wrong so then the next time I do it, I can get it correct much sooner.”

Throughout this process, the UToledo team saw how many students developed a greater awareness of their own learning process and their ability to improve their learning. As Project Lead Barbara Schneider stated: “I think it put strategies in students’ hands and helped them recognize their own agency in their learning.”

Takeaways and Next Steps

UToledo had several main takeaways from its participation in the ACES Initiative:

Faculty development is key to supporting the successful integration of courseware. It should include content on the use of courseware data analytics to drive student interventions as well as how to best prepare students who are enrolled in courses using these technologies.

1. Understanding and using the data from adaptive courseware systems can improve the quality of instruction and the ability of faculty to personalize instruction.

- Instructors need time to learn what analytical data is available to enhance their teaching.
- UToledo recommended scheduling time weekly for faculty members to review the analytics provided by the adaptive product and plan to apply the information to their future classes.

2. Student success relies on effectively preparing students to understand and engage with supportive educational technology platforms such as adaptive courseware.

- Instructors should clearly explain to students how to use the selected courseware and how it can benefit their learning as it may require them to engage in studying and learning practices that deviate from traditional study habits.
 - i. Institutional data found that students spent more time engaging with the course material after the adoption of the adaptive product compared to before the ACES Initiative.
- Faculty members should prepare students to understand the level of individual work expected to progress through courseware, particularly when it relates to remediation. This is especially true in math courses where students often must revisit core concepts before they are able to continue progressing through the content.
 - ii. Faculty and institutions must consider students’ workload and ensure that course design, activities, and student support integrate practices that are centered in equitable teaching design principles.

UToledo plans to continue improving on its adaptive courseware usage in the departments that participated in this initiative. The faculty members who adopted adaptive courseware in anatomy and physiology classes intend to advocate for its use across their department and in other programs, including microbiology and pathophysiology.

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