The Impact of Digital Learning on Minoritized and Poverty-Affected College Students

A Literature Review

everylearner everywhere

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ACKNOWLEDGEMENTS

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Every Learner Everywhere is a network of 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, Latino and Indigenous students; poverty-affected students; and first-generation students. Our collaborative work aims to advance equity in higher education centered 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 institutional practices and market trends. For more information about Every Learner Everywhere and its collaborative approach to equitizing higher education through digital learning, visit everylearnereverywhere.org.

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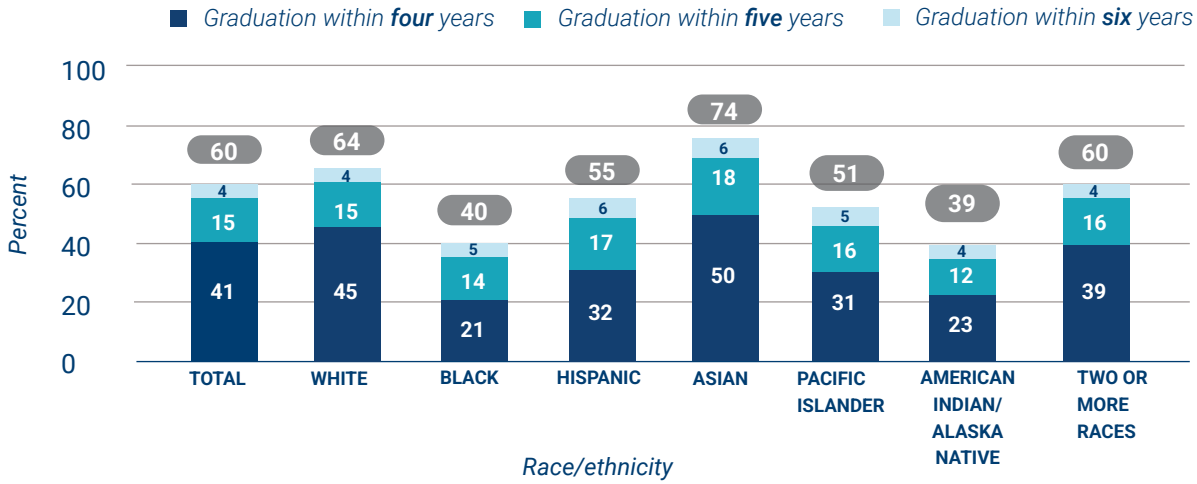
INTRODUCTION

The higher education system shows persistent gaps in student outcomes across multiple measures for historically minoritized students and students from low-income backgrounds. Racially minoritized students are less likely to attend college, and out of those who do, completion rates are low compared to students who identify as white, Asian and two or more races. Only 42 percent of Black students, 57 percent of Latino students, and 39 percent of Indigenous students graduate within 150 percent of the time, according to the National Center for Education Statistics[1].

Figure 1.



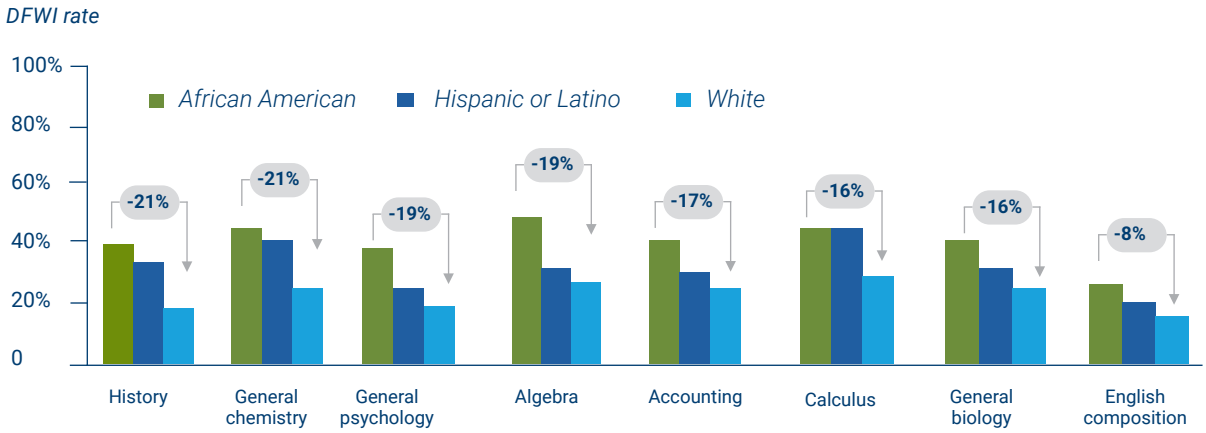
[1] NOTE: Data are for four-year, degree-granting, postsecondary institutions participating in Title IV federal financial aid programs. Graduation rates refer to students receiving bachelor's degrees from their initial institutions of attendance only. The total includes data for persons whose race/ethnicity was not reported. Race categories exclude persons of Hispanic ethnicity. Although rounded numbers are displayed, the figures are based on unrounded data.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Winter 2016–17, Graduation Rates component. See *Digest of Education Statistics 2017*, table 326.10.

An analysis of pass rates in first-year courses by race and ethnicity shows that the equity gap is sometimes as high as 21 percent between Black and white students and reveals an average of 12 percent difference between Pell and non-Pell recipients (Koch and Drake, 2018), as seen in Figure 2.

Figure 2.[2]

Course DFWI rates in first-year gateway courses by race/ ethnicity, 2019



[2] Koch, A. K., & Drake, B.M. (2018)

CONTEXT AND PARAMETERS

The focus of this resource paper is to assess the effectiveness of digital learning in decreasing equity gaps as well as the impact digital learning has on specific student populations: those who identify as Black, Latino, and Indigenous; students from low-income backgrounds; and first-generation students. In this study, *digital learning* includes a broad range of curricular models, content and communication tools, design strategies, and instruction that personalizes learning for students in both blended and online learning environments. This does not include emergency remote instruction during the lockdown and shelter stages of the COVID-19 pandemic as the variables of that situation—such as illness, trauma, and lack of digital learning tools and broadband access—cannot be reasonably included in data collected during normal campus operations. Rather, this study will focus on specifically designed curriculum and pedagogy for online and blended classes. A range of activities fall within the broad definition of digital learning: the use of a learning management system (Brightspace, Blackboard, Canvas, D2L, Moodle) through which the course is fully or partially designed, and then utilized for formative assessments and sharing content, or posting grades, information, and announcements; digital tool courseware in live or online synchronous classes to enhance student engagement (Jamboard, Kahoot!, clickers, polling, Discord) or student collaboration (Google Drive, Microsoft Teams) or for student communication (emails, Zoom, Google Drive); open educational resources (OERs); adaptive software (Realizeit, Lumen Waymaker, ALEKS, CogBooks, WileyPLUS, Hawkes Learning, MyLab); or other technologies.

Does digital learning support racially minoritized and poverty-affected populations enough to create a level playing field for college students of all races, ethnicities, and socioeconomic backgrounds? This study will attempt to answer that question, and for that reason it does not include the blanketed or aggregate impact of digital learning. The primary metrics used to measure student achievement in this study are common higher-education key performance indicators (KPIs): pass rates, retention rates, progression rates, graduation rates, and student survey data.

The data collection initially focused on a traditional literature review of peer-journal articles. However, the research prompted so few results that it was extended to a general search, to include nonprofit organizations focused on digital learning, a few institutions with a reputation of being an exemplar for using learning technologies, and even case studies from the major courseware providers.

Of particular note: Our editorial team asked the Every Learner Student Interns, Chidinmma Egemonu, Eduardo Frausto, and Emma Sullivan, to review this document ahead of publication. Their comments added a great deal of clarity and value of perspective to the study results, so we decided to add them to the document.

DATA COLLECTION RESULTS

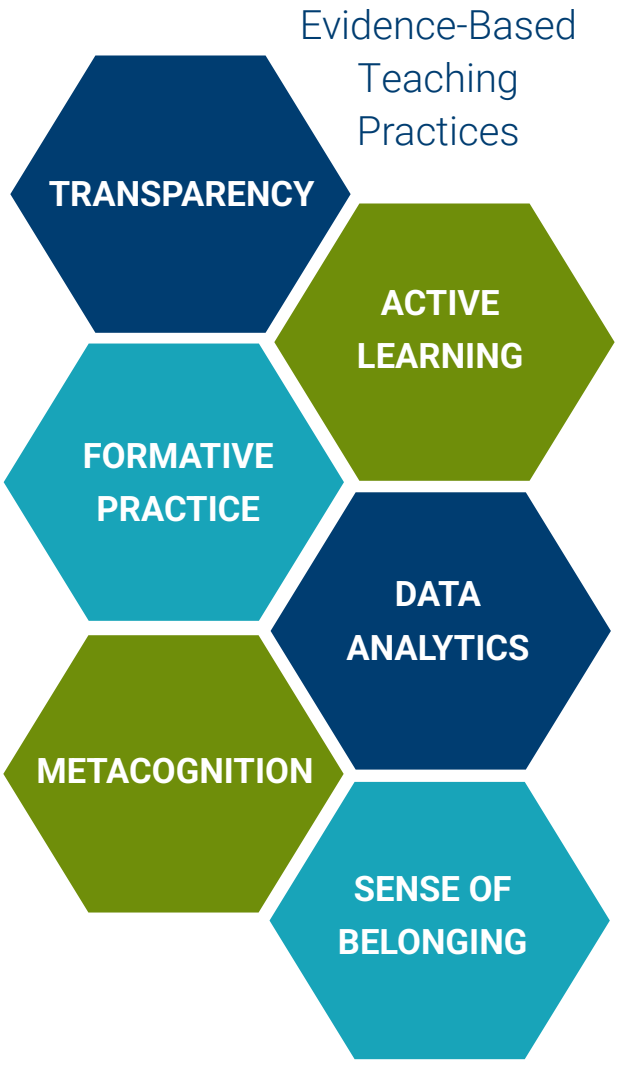
Undoubtedly, digital learning is a powerful tool for student success overall, as documented in multiple articles: Alli, Rajan and Ratliff (2016); Clark and Jones (2020); Clark and O'Sullivan (2020); Dziuban, Moskal, Johnson and Evans (2017); Dziuban et al. (2017); Every Learner Everywhere (2020a and 2020b); O'Sullivan, Forgette, Monroe and England (2020); and Vignare (2020).

Digital learning has the power to close equity gaps in college courses, but only when implemented well. "Evidence demonstrates active and adaptive learning has the potential to improve course outcomes and digital solutions, while lowering the cost of course materials — particularly for poverty-affected students, and Black, Latino, and Indigenous students. Through digital learning, faculty can adapt instruction to students' needs and capabilities, promote active and collaborative learning, more easily support learners with timely feedback, and improve academic outcomes" (Fox et al., 2021, p. 9). **"Yet, it is important that institutions of higher education, especially researchers and practitioners in the education field, recognize that educational technology is not the solution. Rather, it is an element of a solution that should be carefully and intentionally considered as well as implemented as it is possible that educational technology could exacerbate the existing inequities or create new inequities"** (Joosten et al., 2021, p. 4).

This study was a much larger undertaking than originally thought as there are so many aspects to digital learning. No meta-analyses exist on this topic. It is hard to correlate different interventions, and very little published data exists on the impact on underrepresented students compared to digital learning impact overall. Even within the same institution, it is sometimes difficult to compare across programs of study. And underrepresented and minoritized student populations are not a monolith, so different interventions would affect each group differently (McGuire, 2022).

What follows is a summary of the literature and research on the effect of digital learning on two main categories of impactful practices: pedagogy and technology.

I. Pedagogy



When it comes to the top evidence-based teaching practices that support students, Digital Promise[3] conducted a study. These practices are categorized as promoting active learning, supporting metacognitive and self-regulation practices, providing formative practice with feedback, cultivating students' sense of belonging, using data to modify instruction or provide individualized feedback, and being transparent about learning objectives and criteria for success (Peters and Means, 2022).

These evidence-based teaching practices are important because they have long-lasting effects on students. For example, there is equal interest in Science, Technology, Engineering, and Math (STEM) from college students across all races, ethnicities, and social-economic statuses when enrolling in college. However, it is the poor performance in gateway courses—at a higher rate for Black, Latino, Indigenous, and poverty-affected students—that creates the large disproportion of students who switch from STEM to non-STEM majors. In fact, the six-year completion rates for STEM majors are quite disparate: 52 percent for Asian, 43 percent for white, 29 percent for Latino, 25 percent for Indigenous, and 22 percent for Black students. This poses long-term problems as well: a lack of minoritized populations in STEM fields can make minoritized students feel they don't belong in that field. More concerning is that the highest lifetime income among undergraduate majors is from STEM. By having less representation in those majors, it forces the Black, Latino, Indigenous, and poverty-affected students into lower-income brackets (Theobald et al., 2020). Harris et al. (2020) also analyzed this issue. They named it the "hyperpersistent zone" (p. 1) - when this target population is less likely to persist after performing below a C− grade, but more likely to persist if they receive a C grade or better.

[3] Digital Promise is a global nonprofit working to expand opportunity for each learner. They work with educators, researchers, technology leaders, and communities to design, investigate, and scale up innovations that empower learners, especially those who have been historically and systematically excluded.

Active learning makes a difference.

Active learning, simply put, is learning by doing as compared to learning that involves only listening or viewing. An active learning environment is one in which students are engaged by practicing skills, solving problems, discussing learning topics, and writing about what they are learning in their own words. A meta-analysis of 225 studies showed that students in STEM courses that included active learning were 1.5 times less likely to fail than students in courses without it (Freeman et al., 2014).

Theobald et al. (2020) took a similar analysis further. They conducted a literature review on how the teaching approach impacted Black, Latino, and Indigenous students, along with students from low-income backgrounds, and found 15 studies of active learning that resulted in decreasing the equity gaps between students, while 26 studies showed worse results. The collected data concerned exam scores and success or failure rates across a multitude of STEM courses, taught by the same instructor both in traditional lecturing and active learning. Using regression analysis, they learned that **"on average, active learning reduced achievement gaps in examination scores by 33 percent and narrowed gaps in passing rates by 45 percent"** (p. 6676).

In analyzing why some studies showed reduced equity gaps and some did not, they determined that the proportion of time spent by students on in-class activities was important because only the classes that implemented high-intensity active learning saw a reduction in equity gaps. Meaningful reductions in equity gaps only take place when there is deliberate course redesign coupled with active learning. This approach is also known as the heads-and-heart hypothesis. The two key elements when redesigning the courses were found to be deliberate practice - such as extensive and highly focused efforts to improve performance, scaffolded exercises designed to address deficits in understanding or skills, and immediate feedback and repetition—and a culture of inclusion.

We see disparities in student success outcomes as an opportunity for faculty and institutional leaders to implement teaching and learning practices and policy changes that will better support marginalized students.

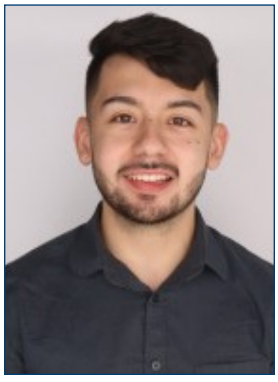
Teaching training matters.

Emma Sullivan, Middle Level Education major at Georgia State University

> **"Culturally relevant/responsive teaching is so important and a frequently discussed topic in my teacher preparatory program. There is an increasing cultural and ethnic gap that exists between teachers and students in America, specifically due to the lack of cultural emphasis in professional development programs.**
>
> **Culturally responsive instructional strategies transform information about communities into effective classroom practices, which increase students' engagement and academic performance."**

Deliberate instruction was also researched by Deslauriers, Schelew, and Wieman (2011) in a Physics course. Their study showed when instruction was provided by an inexperienced instructor, who was trained in cognitive psychology, deliberate instruction, and course content, the course was superior to the traditional lecture-style instruction provided by an experienced and highly rated instructor. The results were higher student attendance, higher engagement, and more than twice the learning in the section taught using research-based instruction.

Another model of active learning that specifically targets decreased equity gaps is peer-led team learning. This is a type of active learning that involves small-groups, used both along with, or in place of, the traditional lecture format. The Snyder et al. (2016) study showed improvements in students' grade performance, attitudes, retention, conceptual reasoning, and critical thinking across multiple gateway courses and disciplines. Looking specifically at the D-grade, F-grade, withdrawal, and incomplete (DFWI) rates by race, **Black, Latino, and Indigenous students' DFWI rates decreased from 40 percent to 15 percent with peer-led team learning.** The other population (white or Asian) also saw a decrease in DFWI rates, from 11 percent to 8 percent.



Eddie Frausto, Marketing major at Georgia State University

> **"We use peer-led team learning in my Marketing classes, and I feel a lot more engaged in class because being the Team Lead makes me more comfortable with the material seeing as I master my understanding of the content by teaching my peers the subject matter. Peer-led team learning guides students toward a solution through their own problem-solving skills. The goal is to teach students how to think about and approach difficult problems."**

"I agree that it is really helpful for students to have time to write and explain their own thoughts in the classroom while sharing ideas in peer-led team learning."
-Chidinmma Egemonu

When looking at other technology-enabled learning environments, Shi et al. (2020) identified 41 high-quality peer-reviewed journal articles in their meta-analysis across a multitude of disciplines, in which 18 of the studies indicated significant positive effects for the digital learning aspect. These stood out for impact on students because they also incorporated individualized and collaborative learning, including active learning, flipped classrooms, and peer learning.

The best impact for students was found in courses with under 200 students. Shieh et al. (2011) also found **there is a correlation between decreasing gender equity gaps in STEM courses by implementing technology-enabled learning environments, but only when implemented according to active learning best practices.**

Online and hybrid course structure is critical.

There are also specific examples of effective pedagogical practices used in hybrid or online courses. **Increasing the class structure—such as adding ungraded readings with guided questions, graded preparatory homework, and in-class questions graded for extra credit—led to increased performance for all students, but it halved the equity gap between white and Black, as well as first-generation students, and it eliminated the equity gap between males and females in STEM courses.** It did not disproportionally help Latino or Indigenous students (Eddy and Hogan, 2014). Joosten et al. (2021) concurred that the mode alone is not the factor that influences students' success, but rather, it is the course design and pedagogical or instructional approach employed (Joosten et al., 2021). The same report indicates that interventions in preparing for online courses, as well as a culturally inclusive curriculum, promote students' success, while a lack of inclusive learning environments negatively impacts it.

Chidinmma Egemonu, Cognitive Studies and Human and Organizational Development major at Vanderbilt University

"There are aspects of my education sociology class that have been helpful for me. The class allows me to contribute and track my progress without always overthinking about grades. This makes me feel less restricted when it comes to sharing ideas in class or in my assignments."

Chidinmma Egemonu, Cognitive Studies and Human and Organizational Development major at Vanderbilt University

"I think this shows how universities could be better at integrating different types of cultural learning methods in diverse classrooms. This is called "fugitive learning" and it is a concept developed by Leigh Patel.

Fugitive learning is a type of learning that takes place outside of formal educational settings, such as in the workplace, in community organizations, or through personal hobbies and interests."

In statistical courses with multidisciplinary project-based curricula, students from racially minoritized and poverty-affected backgrounds found the material more difficult than did their counterparts. However, they were twice as likely to report their confidence, and interest in conducting research, increased (Dierker et al., 2016).

Emma Sullivan, Middle Education major at Georgia State University

"Imposter syndrome is a real issue that needs to be addressed in higher education as it disproportionately impacts minoritized students.

Imposter syndrome is characterized by feelings of doubt around one's abilities and successes as well as fear of being exposed as a fraud or as one who doesn't belong in college."

Increasing the class structure halved the equity gap between white and Black, as well as first-generation students, and it eliminated the equity gap between males and females in STEM courses.

II. Technology

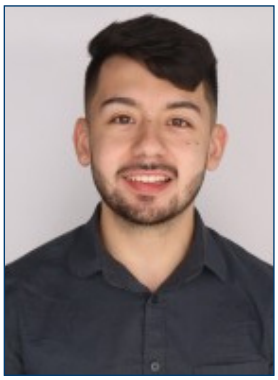
When using technology, **racially minoritized students had positive attitudes toward the use of instructional technology because they perceived it as non-judgmental, providing them with opportunities to review content in terms of their course schedule and course flexibility, as well as a platform for self-expression with no fear of embarrassment** (Kincey et al., 2019; Salvo Shelton, and Welch, 2019). Another study revealed a strong relationship between the use of instructional technology in the classroom and the course completion rate for Latino and Indigenous students, but not for Black students.

However, looking at the student use of the instructional technology, the correlation only existed in the Latino group. Instructional practices, to be impactful, must focus on the needs of minoritized students, and the most significant focus should be on student engagement and quality instruction (Bussell, 2020). Wladis, Conway, and Hachey (2017) found that the most successful courses are the blended[4] lower-level courses, but online for upper-level and major-specific courses. OERs[5] are a cost-saving option but are only equitable when the institutions remove access barriers, such as hardware and internet availability (Joosten, Harness, Poulin, Davos, and Baker, 2021).

"I think that virtual learning methods have made me more comfortable with voicing my opinions in class without feeling judged." -Chidinmma Egemonu

[4] Blended learning is instruction that blends technical, temporal, spatial, and pedagogical dimensions to create actualized learning (Joosten, Weber, Baker, Schletzbaum, and McGuire, 2021).

[5] Open Educational Resources (OERs) are learning, teaching, and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation, and redistribution by others (Unesco, n.d.).



Eddie Frausto, Marketing major at Georgia State University

> **The barriers students face when accessing technology are called the "digital divide." Equitable access to technology is a key issue in education.**
>
> **Digital Divide is the gap between those with sufficient knowledge of, and access to, technology and those without.**

Some digital learning instructional approaches, such as U-Pace from the University of Wisconsin- Milwaukee, have proven themselves successful. Reddy et al. (2013) explain that the model combined self-paced, mastery-based learning with instructor-initiated Amplified Assistance in an online learning environment in one gateway course. U-Pace requires only a learning management system and can be applied to any course or discipline, and resources to help the instructors adopt this approach are freely available. U-Pace impact results show greater learning and greater academic success for all students, and a decrease in the equity gap. **When looking at Black, Latino, Indigenous, Southeast Asian, and poverty-affected students, the results were impressive: 20 percent extra students from this target population receive a grade A compared to regular instruction, and the equity gap is cut in half.** Further testing was performed to ensure that the results could be replicated with a different learning management system, instructors, and university setting. The proportion of A and B grades more than doubled in all cases, and at one university the equity gap was eliminated (Fleming et al., 2016).

Focusing on Historically Black Colleges and Universities (HBCUs), the implementation of digital learning has been shown to be effective in some studies. The University of the District of Columbia used Quality Matters for online course redesign in a study written by Suzan and Harkness (2015). **The learner outcomes included a 19.7 percent increase in A-D pass course grades, a 66.6 percent reduction in F course (fail) grades, and a 23.5 percent reduction in course withdrawal over a five-year period of tracking.**

Data analytics are key to improved pedagogical practices.

Several colleges and universities reveal that use of adaptive courseware and then using data from the courseware to analyze and improve the pedagogy have proven to decrease equity gaps. However, so far there is no study that shows this is the case for all adaptive courseware implementations, as a successful implementation of adaptive courseware depends on many factors.

These factors include the quality of the software, amount of training provided to the instructor, instructor's level of engagement with students, pedagogical strategies used in the course, and thoroughness of the course (re)design, particularly around equity principles. Northern Arizona University has seen **increases in pass rates in introductory general education courses from 76 percent to 85 percent for Latino students, 79 percent to 92 percent for first-generation students, and 62 percent to 82 percent for Black students** (Every Learner Everywhere, 2020c).

Georgia State University decreased their DFWI rates for minority and Pell students in writing courses (Dziuban et al., 2018). The State University of New York has also had great success with adaptive courseware and published their fact sheet (SUNY, 2020). The University of New Hampshire used Inclusive Access software from McGraw Hill and **improved the pass rates by 1.5 percent for white students, 2 percent for Hispanic students, and 13 percent for Black students** (McGraw Hill, n.d.-a). Using another McGraw Hill product, Columbus State Community College decreased the retention gap between Black and white students from 15 percentage points to 3 percentage points in 2018 (McGraw Hill, n.d.-b). Long Beach Community College implemented adaptive courseware in general as well as in their compressed sections of math; they observed that **Black students were twice as likely to pass the course than in a regular section without courseware** (Olderog, 2021).

Clark Atlanta University is also an HBCU. They implemented adaptive learning courseware as a high-impact practice in their General Chemistry course. This included a redesigned course and utilization of the data analytics from the adaptive courseware. Although the overall pass rate was the same, **there was an increase in the percentage of B grades, from 11 percent to 55 percent, and a decrease in the percentage of C grades, down to 33 percent from 82 percent** (Ingram, Mintz, and Teodorescu, 2019).

> **"I like adaptive courseware like McGraw Hill Connect for writing courses because they have many self-paced studying options and provide resources on writing for assignments." – Eddie Frausto**

Preparatory courses with adaptive learning help students perform better than remedial courses, and even in subsequent courses, both when done in the summer and when OER is introduced.

A large meta-analysis found that blended courses outperform both face-to-face and online instruction (Means et al., 2010). Furthermore, House et al. (2018) found that students from low-income backgrounds using adaptive or personalized learning software received scores that were statistically significant, 0.1 standard deviations higher.

Preparatory courses with adaptive learning help students perform better than remedial courses, and even in subsequent courses, both when done in the summer (Hickey, Robinson, Fiorini, and Feng, 2020) and when OERs are introduced (Fischer, et al, 2019). In the Next Generation Courseware Challenge report, 10 institutions implemented adaptive courseware, in multiple disciplines, and with multiple software. Five of those showed statistically significant results for minority students. The same study showed two studies statistically significant for students from low-income backgrounds (House et al, 2018).

According to the result of the Time for Class 2022 survey, less than a quarter of faculty report using courseware primarily to ensure course materials are culturally inclusive or to improve outcomes for Black, Latino, and Indigenous students and students from low-income backgrounds. However, the majority of faculty who use courseware believe that courseware can advance academic performance for Black, Latino, Indigenous students, and students from low-income backgrounds, as evidenced by a reported 57% improved performance (Yuan et al., 2022).

There were also other reports that showed that the digital learning strategies used did not support this specific target population. In the Adaptive Learning Market Acceleration Program, four implementations had slightly increased outcomes for students from low-income backgrounds (Yarnall, Means, and Wetzel, 2016).

CONCLUSION

Our research exposed a serious paucity of studies exploring the impact of digital learning on Black, Latino, Indigenous, poverty-affected, and first-generation students. Studies are scarce, and when they exist, they are limited. Many articles tout the importance of digital learning in general, but higher education must not fall for techno-solutionism and adopt software without knowing who benefits from it, whether it might harm specific student populations, and without an intentional implementation to ensure the tool will benefit traditionally and systemically excluded students.

The field at large could benefit from more publications on this topic. More research would be beneficial, especially as digital learning has become integral to all higher education instruction. It was very clear that there is extensive research conducted and published on digital learning as a whole, but it is sad that so few articles decided to disaggregate the data. The real story takes shape when you look in depth at specific populations. Long gone should be the times when we believe that what works for one student works for all equally. Each student has their distinct needs: individualized instruction through digital tools can improve their academic achievements. Much of their success is dependent on equitable, evidence-based teaching practices. We all need to better understand how this affects minoritized students and students from low-income backgrounds, and that harm may be done to them by utilizing digital technology without proper training, redesigned curricula, or intentionality.

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