ReWriting Writing

Establishing Pedagogical and Evidentiary Paradigms for Digital-Forward Instructional Design in Postsecondary Writing Courses

A Workshop Report by
Myk Garn
Rob Kadel
Elizabeth Sanders Lopez

Addtional Contributors:
Michael Feldstein
Peter Foltz

Association of Public & Land-grant Universities | everylearner everywhere

Table of Contents

Recommended citation

Garn, M, Kadel, R, and Lopez Sanders, E. (2021). Re-Writing Writing: Establishing Pedagogical and Evidentary Paradigms for Digital-Forward Instructional Design in Postsecondary Writing Courses. Joint publication of Association of Public & Land-grant Universities and Every Learner Everywhere.

Acknowledgement

This work was supported by grants from the Opportunity Fund managed by the Rockefeller Philanthropic Advisors for the Bill & Melinda Gates Foundation and Every Learner Everywhere. The ReWriting Writing project was managed by the Association of Public and Land Grant Universities (APLU) along with colleagues at the University System of Georgia (USG). The team at APLU included Dr. Karen Vignare, Julia Chadwick, Rishon Seaborn, and consultant, Rob Kadel and at USG, Dr. Myk Garn. Any opinions, findings, conclusions, or recommendations are those of the authors and do not necessarily reflect the position, policy, or endorsement of their organizations or the funding agency.

Participants

Dair Arnold	Sinclair Community College
Aimee Berger	Wiley/Knewton
Norman Bier	Carnegie Mellon University
Lauren Mason Carris	Western Governors University
Don Carter	Northern Arizona University
Andrew Davis	University of Mississippi
Jessica Everton	The NROC Project
Catherine Flynn	Southern New Hampshire University
Peter Foltz *	University of Colorado, Boulder
Karen Forgette *	Michigan State University
Chuck Freeland *	University System of Georgia eCampus
Jeff Grabill	Jackson State University
Nihal Gunay	Clayton State University
F. Janelle Hannah Jefferson	State University of New York
Justin Mays *	National University
Mark McBride	Miami-Dade College
Frank Montesonti	Louisiana State University
Caitlin Richardson	Straighterline
Jen Sands	Arizona State University, EdPlus
Sasha Thackaberry	Florida International University
Joe Thibault	National University
Peter Van Leusen	University of Central Florida
Leanne Wells	
Greg Wilt	
Shelly Wyatt	

Wranglers

Julia Chadwick, APLU

Rishon Seaborn, APLU

Guest Presenters

Michael Feldstein, eLiterate

Barbara Means. Digital Promise

Julie Neisler, Digital Promise

Leaders

Myk Garn, University System of Georgia

Rob Kadel, Georgia Institute of Technology

Elizabeth Sanders-Lopez, Georgia State University

Karen Vignare, APLU

* also presented

Foreword

When I was approached to participate in a workshop with a group of experts from around the country to talk about connections between technology and writing instruction and, further, to imagine and shape our future in a positive way, I was immediately interested. As a scholar, writing teacher, and writing program administrator, questions of best practices in writing pedagogy, student engagement, and technology use permeate my daily work. To be in a virtual room with dozens of colleagues ready to share insights and grapple with the hard questions and challenges we face -- feels like heaven! After all, this collegial collaboration models what writing teachers hope for in their classrooms every day.

One impetus for this workshop was student success. We carefully design writing courses with student diversity in mind, but the reality is that some students are not succeeding. Our data show that a percentage of students are inequitably prepared to enter the college classroom and that more struggle there to meet the demands placed on them. Instructors work diligently to offer individualized writing instruction and timely feedback often under the added pressures of courses with enrollment caps set too high, and a host of writing and student learning issues to address. Further, in the current context of 2020 and 2021, with the inescapable exigency of providing online instruction and remote learning experiences, often on-the-fly, there has been much more to lament and worry about in these arenas.

Some readers might be wary of the phrase “digital forward instructional design,” worried that any focus on technology as a potential redress will lead us down the slippery slope of contingent labor, large class sizes, and ultimately, to replacing human faculty with machines.

Of course, such caution in regards to the embrace of technology is wrapped up in very legitimate concerns and the material and economic conditions of the teaching of first-year writing. But I write to remind all who care about college-level writing that the field of composition studies and post-secondary writing instruction has a rich history of engaging with new technologies in ways that are robust and critical (as defined by philosopher Andrew Feenberg). At each turn, we have considered how we design our courses and what technologies should be adopted based on our field’s values and deeply held beliefs about writing, pedagogy, and student learning. We have a wealth of scholarship on which to stand, starting with the early, groundbreaking work of Cynthia Self and Gail Hawisher in the 1990s, when we saw that desktop publishing and teaching in computer-rich environments was changing the writing landscape to our present scholarship about new and social media. And the Conference on College Composition and Communication (CCCC) Position Statement for the Postsecondary Teaching of Writing maps for us the foundational principles on which to rely.

Foreword

In the classroom and in professional development, our mantra is often that teachers should do what they do best and encourage students to do what they do best. Why not also imagine letting technology do what it does best? In this atmosphere, we all succeed. This report is a deep dive into how the twenty-first century writing course works and how we all play a role in student success.

Listening to disciplinary experts with rich and diverse experiences will move us forward, helping us to imagine together what we do well, where our blind spots are, where we rush in, where we are reluctant or fearful, where we need to speed up or slow down. All of those reactions are meaningful and deserve to be heeded as we go about the business of instructional innovation and improvement.

In this kairotic moment, we are uniquely poised to leap forward, having many previous concerns or hesitancies about technology and writing swept aside, however unceremoniously it happened. This workshop provided a bright pause for many of us to consider more deeply our relationship to technology, to unpack and closely examine the structure of a composition and course, to consider anew what teachers and students do best, and how we might enable our best selves to come forward if we open the door to using technology in responsive and responsible ways.

I commend this report to you as an entry to the conversation we had and invite you to dialog along with us as we envision a leap forward for the design of writing courses. This report is a summation of our six-week workshop but is only the beginning of what we hope will be a national dialogue about a digital-forward design movement focused on disciplinary best practices and student success. We commend this report to you and look forward to the conversation.

Enjoy and imagine!

Elizabeth Sanders Lopez
Georgia State University

Introduction

"It is imperative that writing programs understand their students and the risks they face in progressing successfully through first-year writing and composition courses."

(EAB, Fink & Jenkins)

Writing, like reading and math, is a gateway skill students must develop and master in order to succeed in college and beyond. A skill too many students have been inequitably prepared for when they start college.

Gateway writing courses in postsecondary education are expected to fulfill many objectives, including the teaching of critical thinking, rhetorical and situational analysis, and research skills, along with the mechanics, roles, and styles of writing they will encounter and be expected to employ throughout their collegiate and professional careers.

Pedagogical and assessment models for college writing set the bar and this bar is, appropriately, the same for all students. However, the skills, knowledge and experiences with which students enter college are not at all the same, a fact not accounted for by current instructional models. Thus, as Professor Lopez notes in her foreword, the current models for teaching college-level writing do not work for all students. This is especially true for those who enter inequitably prepared, barely-funded, or (usually and) with complicated lives and jobs beyond the classroom. The disparities among students are, in fact, so wide that instructors and learners alike struggle with recognizing let alone filling the gaps, leaving little time to master the stated objectives of the course in the fifteen or so weeks allotted.

The evidence of this challenge is clear.

In a study of 256 Foundations of Excellence institutions conducted by the Gardner Institute for Excellence in Undergraduate Education,[1] the average percentage of students who either withdrew from a course or completed it with a grade of D or F (or DFW rate) for the five highest enrollment first-year courses at two-year and four-year was 35% and 25%, respectively.

It is widely understood that gaps in foundational skills and knowledge with which students arrive in these courses play a large role in setting the stage for the traditional approach to countering these deficits. These gaps have sequestered inequitably prepared students into separate developmental education sequences where they can build their elementary and intermediate skills before progressing up to a collegiate level course.

Introduction

But, the 'developmental sequence before collegiate' course model has not worked.

Developmental English was among the top five of courses with the highest DFW rates at both two-year and four-year institutions.[2] Specifically, in developmental English, the DFW rates were 43% and 34%, respectively. In contrast, the DFW rates in College English, the rates were 33% and 20%. The Gardner Institute study labeled these "killer courses" because of the negative effect they have on a student's GPA, progress through their program, scholarship eligibility, motivation, and even interest in staying in college. Smith Jaggars[3] notes that low completion rates in developmental courses, in particular, place underprepared students at a significant disadvantage in completing the rest of their studies.

A deeper look into the numbers shows where the challenges are greatest. A report that examined over 200 indicators, looking at who gains access to a variety of educational environments and experiences by races and ethnicities, found that by the end of high school, Black students were less prepared than White students for college-level work.[4] In 2015, 64.2 percent of all Black 12th graders were in the lowest achievement level for Math and 47.6 percent were in the lowest achievement level for Reading, a pattern that remained consistent when considering income and parental education levels. This deficit went on to impact their postsecondary success, as Black students in career and technical education were less likely to complete their credentials in potentially higher-paying fields. This is a complicated dilemma, and the instructional model is not the sole cause of student struggles. EAB,[5] a postsecondary education consultancy, identifies several non-academic reasons (such as financial, personal, and emotional factors) that contribute to first-year difficulties.

Postsecondary education has not been complacent in crafting new approaches. The University of Maryland at Baltimore County has made enormous progress in student success. With a six-year graduation rate of 20 percent for Black freshmen in the 1980's, UMBC increased the six-year graduation rate to 70 percent overall while also erasing a 10 percent Black-White graduation disparity.[6] UMBC leaders credit a focus on redesigned introductory courses that emphasize active, problem-focused, and group-based work, alongside the addition of academic advocates to work proactively with inequitably prepared students to ensure their success by connecting them with resources such as tutoring and counseling. These changes along with other innovations such as residential learning communities, experiential learning opportunities, and a career center to help students with internships and jobs enhance the student experience and reinforce persistence.

Shifting from developmental sequences to corequisite scheduling for killer courses has also proven effective. Instead of sequestering students in Developmental courses and sequences, emerging models are making the developmental support a corequisite to the college-level course. In this model, the Developmental, often called a Support, course is scheduled in the same term to increase the proximity and immediacy of the support for the objectives of the collegiate course.

Introduction

Studies documenting the success of corequisite remediation are driving increased adoption of this model. A 2019 study by Ran & Lin[7] of the model at 13 community colleges in Tennessee showed that "for students on the margin of the college readiness threshold, those placed into corequisite remediation were 15 percentage points more likely to pass gateway math and 13 percentage points more likely to pass gateway English within one year of enrollment than similar students placed into prerequisite remediation. Compared to their counterparts placed directly into college-level courses, students placed into corequisite remediation had similar gateway course completion rates and were about 8 percentage points more likely to enroll in and pass a subsequent college-level math course after completing gateway math."[8]

> Innovations and optimizations to our current instructional models, like corequisite remediation, have resulted in significant but incremental increases in success. As a result of the workshop detailed in this report, we conclude technology provides the opportunity to make even greater, potentially game-changing, advances. Specifically, we have identified strategies, tactics, and tools with the potential to dramatically alter the restrictive (and inequitable) constraints of time placed on students who are poorly prepared for, and struggle in, college-level writing courses.

Setting the Bar for Success

"I believe an important task and instruction is to seek ways of accomplishing [the 2-sigma increases in learning achieved under] one-to-one tutoring, which is too costly for most societies to bear at lage scale."[9]

(Benjamin Bloom, 1984)

On January 24, 1984, the same year Dr. Benjamin Bloom was setting the bar at 2-sigma for instruction, Steve Jobs was using a decidedly dystopian video[10] to introduce the world to the first Macintosh computer. Their creations continue to drive research and change in postsecondary education. To achieve the utopian goal of reliably and affordably increasing learning by 2-sigma, more than ever, clearly requires an Orwellian bargain with technology. This is challenging, concerning—and necessary.

Bloom's 2 Sigma Dilemma

Bloom,[11] in a comparative study of a broad list of instructional modes, found that the most successful way for students to achieve mastery of a topic was with immediate proximity and access to an instructor. His analysis showed that tutorial instruction, or a student-to-teacher ratio of 1:1, was twice as effective an instructional modality (producing a 2-sigma increase in learning) than any other single instructional method. The dilemma, which has driven research across the intervening years, is to achieve the goal of 2-sigma learning gains from 1:1 instruction, in the 30:1 conventional classroom/course model.

This goal becomes even more challenging, especially for under-prepared students, when writing is taught using online courses. The paradox that online courses can increase geographic access and make time more flexible—at the cost of removing the human-to-human proximity and engagement—is significant, and vexing.

Digital is Here...and It Isn't Going Away

This report is premised on two hypotheses. First, the presence, roles, and responsibilities of technology in the instruction of writing will increase. Second, that technology provides novel ways to understand, address, and resolve the time challenges and equity disparities of current models.

Technology is Not Waiting for Us

The plethora of product announcements, articles, and editorials announcing the imminent arrival of disruptive instructional innovations—and the growing obsolescence of current practices (and practitioners)—are legion. They are neither wholly right—nor wholly wrong.

Private investment in learning-technology companies is robust and growing. Investments have increased globally, from $2 billion in 2012 to $19 billion in 2019.[12] A preponderance of these investments is in the rapidly expanding (and increasingly profitable) field of artificial intelligence (AI). The 2020 Gartner Hype Cycle for Emerging Technologies,[13] which evaluated 1,700 emerging technologies to produce a concise set of the 30 most transformational in the next five to ten years, for the first time included AI-specific technology.

The ability of technology to perform tasks that were once the sole domain of instructors, will continue to increase. Self-supervised learning, using machine learning techniques, will extend the applicability of machine learning to organizations that do not have the availability of large datasets. For example, both students and faculty rely on spell checking tools with a high degree of trust.

Secondly, the use of well-designed and increasingly intelligent technology will provide novel affordances with which students can master college-level writing—and for instructors to guide and mediate their learning more effectively and efficiently.

Why We Need Technology

Society is in the midst of a tsunamic shift from analog to digital paradigms. When creation moves from the handmade to the machine—whether from scribes to printing presses, from artists to photoshoppers, from money changers to accountants—transformation is inevitable.

In education, we are evolving from a centuries-old model of individual instructors orating, guiding, and assessing a small cohort of penitent students into a digital ecosystem of assisted intelligence, on-demand attention, and collaborative learning partnerships. Failure to recognize the immensity of this change, nor to engage in the creation of these transformative models, is not an option. It is a necessity.

Change the Equity Equation with Time

Digital forward design is first and foremost about diversity, equity, and inclusion. Technology applied wisely can transform the transactions of writing instruction into an equitable and effective experience individualized for all types and capabilities of learners.

In the early 1900's, the assumptions that guided development of our current course models were based on the concept that students who learned faster were smarter, and that students, given the same fifteen weeks to learn, who did not progress as fast, were less intelligent. As recently as 2015, this was affirmed by the Carnegie Foundation in their report[14] on the credit hour, justifying its continued use as a proxy for learning by stating "At least the credit hour gives every student an equal chance to learn." Equal instruction time will result in neither equal—nor equitable—results for all students.

In this approach, equity means finding a way to get all students to the same performance bar of college-level writing ability. In every course we are bound by the constraint of time. Today, especially at colleges with large numbers of inequitably prepared students, instructors simply do not have enough time to help every student catch up. Not that they don't try. Many have writing labs, others may employ online

writing resources like Smarthinking, and these are very useful. Though this inappropriate term-based, 'equal-time-to-learn' measure must change, we will need to employ more and different paradigms to expedite and scale effective solutions for all learners.

Digital tools promise new ways to change what currently appears to be a zero-sum game. Teaching inequitably prepared students in a fixed-time model is a complicated dilemma, and the traditional class model is not the sole cause of student struggles but, our workshop experts were confident that a large part of the solution should focus on time—and timing. This includes time to focus, tutor, and guide each learner according to their individual needs; timing in terms of providing the right instruction at the right time.

The differentiator, hard-coded into our current course models, and the difference between success and failure for many studentsis time.

> **Mastery Learning.** The competency-based education movement, which has gained traction in both K-12 and postsecondary environments, is providing successful examples of the benefits of shifting from the conventional model of limiting a student's time to learn to a model that gives each student the time needed to achieve, changing the measure of success from "what can one learn in 15 weeks?" to "what can one master when given the time and tools necessary for learning?" And, making Bloom's 2-Sigma performance bar a realistic, and achievable, expectation.

Time lost between writing and receiving feedback is a significant limitation of the conventional model that can be significantly improved using the digital-forward model. A recurring mantra of this workshop was 'the more a student writes, the better their writing becomes.' This being the case, time lost waiting for feedback, which is to say time lost from writing, can be clearly seen as an impediment to student progress in the writing course.

In their process of writing, students grapple with multiple concerns and face many decisions. They wonder if they've understood the assignment correctly, if they've chosen a good topic, if their ideas are coming through. They make decisions about exactly what they want to say or show about the topic they've chosen, how to arrange their thoughts, how much information is enough, when to cite sources, how to use commas and what their writing sounds like to the reader ("does this make sense?"). Questions present themselves as the student is writing, not as they are sitting in class learning or thinking about writing, and consequently, the student writer often comes to a point at which the many uncertainties that have presented themselves become a barrier they can't get past on their own. How often do they reach this barrier while the instructor is conveniently standing by to answer their questions? Given the busy lives of students, 70% of whom are also working at least 20 hours per week (according to a 2018 report from the Center on Education and the Workforce at Georgetown University[15]), it's unlikely their availability to study will correspond exactly with instructor availability.

They also confront questions they had not perceived, and therefore not asked, in the classroom. As these questions and concerns build up in a writing session their writing can stall. The sooner this need for answers and feedback can be addressed, the sooner they can move forward with their writing. However, because the instructor is not present, while students are actively engaged in writing, and the session, especially for working students, may be outside the 'working hours' of faculty—the student may have no choice but to stop writing until they can get the feedback they need.

Time constraints on writing limits a student's learning; it also limits an instructor's availability to support. Instructional capacity is premised on the amount of contracted time the instructor will spend preparing, delivering, guiding, and grading a set number of 'average' students during the term. In the classroom, the instructor can only answer questions one at a time, and outside the classroom, during scheduled (office hours), or available (ad hoc) times, mostly during the day. Papers can only be reviewed one at a time, taking several days to return to the student. Typically, in a two-year college, an instructor will be teaching five courses per semester which further extends response and feedback times. Most challenging, time does not flex well when the preponderance of students in a course section need additional time and attention to achieve mastery—as is often the case in open-enrollment institutions such as community colleges.

In interviews with students about the responsiveness of their faculty in answering questions, mentoring, and guiding, the students almost universally report the quality of their interactions as engaged and motivating. When asked about faculty availability when students, especially working students, study (which is often in the evenings and early mornings), students responded with, "We know our professors have lives. We can wait until they are in the office or online." But, in truth, just as faculty shouldn't be expected to be online 24 hours a day, seven days a week, students should not have to wait when they need assistance and direction. Because the limitations of immediacy are so obvious, and have been for centuries, it is most difficult for designers to even identify immediacy as a problem. Indeed, it is a law of physics. Neither instructors nor students can be in two places at once. Digital technology can help mitigate this limitation and open up new avenues of communication and collaboration between teachers and learners.

Technology has the potential to revise the time-to-mastery equation. We believe that, through the use of digital feedback from tools such as content analysis, automated rubrics, and intelligent agents, students can get the feedback they need from these tools to keep writing without needing to wait hours, or days, for feedback from an instructor. Immediate availability of feedback—on student demand is a game-changing affordance of technology and an essential characteristic of digital-forward design.

Time and Equity: A Koan. We know that students who enter a course better prepared are more likely to perform better and progress more quickly. We also know not all students enter a course equally prepared. The goal of the instructor and the course design is to make them equal by the time they complete the course. Unfortunately, assuming that the same content, equal time, activities, assignments, and rubrics will dispel the inequality is irrational. Yet it would be unfair to both groups to hold students with lesser preparation to lesser standards. Equal instruction will not result in equal - nor equitable - results.

Students and Instructors Need More Time...and More Data.

Paucity of time is not the only instructional barrier that digital forward design addresses. There is also a paucity of data. The more we learn about the value of 'big data' in digital ecosystems, the more we realize we do not yet have that much detailed, digital data about our students.

Instructors get to know their students in many ways: by observing their behavior in class (directed attention, active listening, contributions to discussions); through their writing; and through one-on-one interactions. Not surprisingly, writing instructors report they get to know their students best through student writing. In a digital forward model, opportunities for getting to know their students abounds, as instructors have access to a robust stream of data that can add to overall understanding.

The challenge, however, is that instructors already have more data than they can manage. For example, adaptive courseware produces dashboard analytics, real-time reports and even email digests on student activity that regularly go unviewed and unused by instructors. The combination of observational and digital data from 25 students per section times three to five sections per term is simply overwhelming. The rational response is to privilege data you trust (observational) and reject or at least de-prioritize data (digital) you either don't trust or is unclear in its articulation or too raw to be actionable. This clash of data types, coupled with the explosive growth of digital data—and diminished observational data in online and hybrid courses—is approaching what we believe to be a significant point of instructional inflection.

Our solution is not to stop the digital data flow, but to actually increase it!

How Will More Data Help?

A useful heuristic for evaluating what some call the Product-to-Market fit of technology is Moravek's Paradox.[16] Moravek states that tasks which are easy for humans, like grading essays, are hard for computers, and tasks that are hard for humans, like rapidly comparing a given paper against thousands of other papers and sources for plagiarism, are easy for computers. We continually encounter this paradox as we move from a model of individually crafted, bespoke teaching to one of mass-customized learning experiences.

Setting the Bar for Success

When data is modest, it takes the human skills of an experienced instructor to intuit meaning. But instructors, no matter how expert, have finite limits to the amount of data they can manage, and the time they have to manage it. Effective instruction depends on conservation of time, which can be accomplished by limiting the number of students in a course and also constraining the number of activities and essays assigned. Much of the data acquired by the instructor, particularly data of the (privileged) observational type, is logged only in the instructor's memory, and so largely unavailable to anyone else and lost to time, diminishing once the next term starts.

Conversely, as the data for analysis expands beyond these human limits, the efficacy of technology-based analysis increases. While we are not (yet) capturing sufficient digital data in such a way that algorithmic tools using natural language understanding (NLU) and machine learning can make sense of the data in ways that are actionable for both the instructor and the student, this transition point—from limiting data to human manageable levels to building increasingly larger amounts of available data—is where writing instruction finds itself today. The question then, is "How might we design writing courses in new ways for generating and capturing the data needed for increasingly effective teaching and learning?"

What Are We Waiting For?

Faculty are the essential resource of instruction. But, all the 'helpful' affordances of a Learning Management System (LMS), courseware and other technologies, and the limits of the term schedule, render them a very time constrained resource. Add to this the human limits of too much learner data for them to manage and too little time to act upon it, and they are a data constraint as well. Digitizing the data and using more intelligent technologies will free up time for instructors—and students—to catch-up, keep-up, and achieve mastery.

Pushing back on the AI revolution are concerns about unknown, and perhaps unknowable, algorithmic biases. Several common machine-learning models, such as neural networks, are so complex that even the engineers who design them struggle to explain precisely how they work. Despite concerns, which we are working to understand and address, and the above limitations, we are not waiting.
In 2018, resulting from the work of eight universities over three years, the Personalized Learning Consortium (PLC) published this definition of adaptive courseware: "[it is] a digital instruction tool that provides a personalized learning experience for each student. It includes instructional content and assessment that is scoped and sequenced to support an entire course."[17] Instructors are exploring and experimenting constantly. The search for new learning models is resulting in ever-deepening experience and innovation using learning-level telemetry to inform adaptive learning and so make competency-based and mastery learning far more measurable and achievable.

Moving Forward Digitally

A paradigmatic change that has been talked about ad boredom is moving from 'sage on the stage' to 'guide on the side.' This is a misleading metaphor. In online learning, for example, instructors have already moved on from the live lecture model relying instead on text or video presentations of 'content.' but they are still, and always need to be, the sage in the room. So, while technology has taken center

stage for the delivery of content, instructors remain front and center in the role of guiding learners. We label this type of instruction as 'instructor-forward', which dominates the landscape of college education. In this model, the instructor is the designer, deliverer, diviner, and assessor of the course.

When technology is added to the instructor-forward model, it is most often deployed in support of the work the instructor is already doing. Think spelling, grammar, and plagiarism checkers, citation managers, even the learning management system itself. As new tools, such as adaptive courseware, are 'bolted-on' to the course, they add to the amount of time and data an instructor must manage. For this reason, we have seen many adaptive tools used as practice or homework the student does in addition to other assignments. And the results of this 'side-work' are often reported back to the instructor in very coarse metrics such as percent completed. Such measurements are useful for identifying needed interventions but not for deep understanding of learner challenges, especially over multiple assignments and/or across multiple courses.

Even if the software can produce more granular, more informative data and reports, instructors are challenged to find time to review such detailed information during the hurly-burly of instruction. As a result, even real-time data is not used responsively on behalf of the learners in the current course. If used at all, this real-time data is only collected retrospectively for use in considering revisions for future iterations of the course.

Thus, the instructor-forward model, where a single instructor is responsible for all aspects of a course during the term is becoming an increasingly challenging—and out-moded—paradigm for effective, equitable, instruction. To move forward we need to consider new models, ones where instructors and learners interact with an ecosystem of technologies, some of which remain in the background and others that will move increasingly to the fore.

This digital transformation of teaching will make instructor roles even more pivotal—and likely very different. To connote this new vision of instructional design, we use the term 'digital-forward.' In our context, digital-forward course design proposes a preponderance of a student's learning transactions will be conducted via technology and mediated/orchestrated by an instructor. Unlike the conventional (and pejorative) definition of distance-learning where a student and instructor are separated by distance in digital-forward design they are connected by technology and are able to move forward together to achieve the goals of the course.

The goal of digital-forward technology is to under-gird the strengths of the instructor while leveraging the capabilities of technology to increase engagement and create more opportunities for synthesis among the many activities and products of learning in the course.

The Work of the Workshop

Digging into Digital-Forward Design

Like changes in the weather, we can intuitively know a change is coming, but be unsure of exactly what it is or when it will arrive. Moving from a theoretical understanding of digital-forward design to actually describing what digital-forward could, and should, look like in operation would require a small cadre of innovators.

We invited a diverse range of digital learning experts (including academic technology leaders and instructional technologists, writing faculty, teaching and learning center directors, and writing department chairs) to bring their distributed knowledge of digital tools to a four-session virtual workshop. Working together we would collect and organize more than each of us knew individually. The workshop, held during the Fall 2020 term, challenged participants to address current barriers to digital instruction, especially in the online environment of instruction, which had become de rigueur during the Covid-19 pandemic. We were more than proven right, and rewarded.

In addition to bringing more understanding to a theory of digital-forward design we wanted to build an example that would advance the discussion around, and ability to develop, a digital-forward course. Looking within the universe of courses developed through the work of the PLC, we elected a course that was both necessary to student success in postsecondary education and among the most challenging to shift from instructor-forward to digital-forward.

Table 1 - Fall 2020 term workshop participants

Institution/Organization	Type	Number of Participants
APLU	Non-Profit	4
Arizona State University	Higher Education - 4-year	2
Carnegie Mellon University	Higher Education - 4-year	1
Clayton State University	Higher Education - 4-year	1
Find Your Grind	Publisher/Developer	1
Georgia State Unviersity	Higher Education - 4-year	1
Louisiana State University	Higher Education - 4-year	1
Miami-Dade College	Higher Education - 4-year	1
Michigan State University	Higher Education - 4-year	1

continued on following page

Table 1 - Fall 2020 term workshop participants (continued)

Institution/Organization	Type	Number of Participants
National University	Higher Education - 4-year	2
Northern Arizona University	Higher Education - 4-year	1
Pearson	Publisher/Developer	1
Sinclair Community College	Higher Education - 2-year	2
Southern New Hampshire University	Higher Education - 4-year	1
State University of New York	Higher Education - 4-year	1
StraighterLine	Student Success Org.	1
The NROC Project	Publisher/Developer	1
University of Central Florida	Higher Education - 4-year	1
University of Mississippi	Higher Education - 4-year	2
University System of Georgia (System/eCampus)	Higher Education	3
Wiley	Publisher/Developer	1

Writing is different (than math)

Primary indicators of student success in college include entry skills for, and success in college-level reading, writing, and math. Evidence[18] shows that investments to increase students' reading, writing, and math skills pay large dividends in terms of increased rates of student achievement, student performance, progression, and graduation.

Adaptive learning technologies are a good fit for math courses, and have been proven to improve student grades when properly implemented. However, no such adaptive products exist to support students in postsecondary writing courses. And for good reason. Learning to write is very different from learning to do math. In entry level college math there are discrete, transparent rules and processes with right and wrong answers. Where there are distinct right and wrong answers to questions, it is easier to program tools to direct and remediate students. In writing, while there are rules, there are no set nor predictable ways writers will use—or creatively break—them. Teaching and assessing the rhetorical and contextual nuances of writing requires the expertise of the instructor throughout the learning process.

A Workshop to Rewrite (the Instruction of) Writing

We challenged the workshop participants to address the inequities of time and the paucity (and possibilities) of data. Using 'journey' models to explore and describe the essential elements and transactions of the college writing course, the student writing process, the writing assessment process, and a draft set of Principles for Digital-Forward Course Design, they developed criteria to measure achievement of the principles and used the principles as a lens to assess the potential for educational technology and new pedagogies to make the college-level course more equitable and effective for all students.

Guiding Principles for a Digital-Forward Writing Course

"Nobody yet knows the languages inherent in the new technological coulture"

(Marshall McLuhan, ca. 1969)[19]

Learning to write, just as teaching how to write, is far more an art than a science. That said, the amount of canonical guidance developed by writing associations, publishers, colleges, and individual instructors is voluminous. Working from institutions' best practices in first-year composition, we established a model to depict student progress through the writing process. We built a journey map based on an Instructor Guide and Student Manual developed and used by the writing faculty at Georgia State University. These tools, like many of the others we examined, are built around the guidelines of the Council of Writing Program Administrators.[20]

Describing Digital-Forward Design
Digital-forward design proposes a preponderance of a student's learning transactions will be conducted via technology and mediated/orchestrated by an instructor. Unlike distance-learning where a student and instructor are separated by distance—in digital-forward design they are connected by technology—and able to move forward together to achieve the goals of the course.

In the first workshop session, we explained the intent and aspirations of digital-forward course design and asked participants to identify and describe the ways in which digital-forward designs might be different from instructor-forward course design models. The result was a set of differentiating factors, and the criteria by which to measure them. We have codified these into the Principles for Digital-Forward Course Design.

Throughout the workshop, participants were asked to identify goals and metrics by which the Principles for Digital-Forward Course Design could be measured (these proposed measurement criteria are in the Appendix). Like most principles—and the criteria by which they are measured—the Digital-Forward Principles are both actual, and aspirational, in nature. They are, in fact and purpose, a starting point for consideration, discussion, and development towards an even more explicit guide for designers, instructors, administrators, and students as our increasingly digital future becomes increasingly present.

Principles for Digital-forward Course Design

1. Equity: Prioritize accessible, inclusive learning environments that provide support relative to each student's level of need, where every student can get the instruction and support needed to achieve mastery of the learning objectives.

2. Engagement: Foster connections among students, instructors, and content that inspire, motivate, and promote progress in learning through relevant support of learner experiences, agency, metacognitive reflection, planning, and actions.

3. Interaction: Facilitate both instructor- and student-initiated activities and communications that are dialogic, generative, and actionable.

4. Instruction: Use multi-directional approaches to sharing foundational course knowledge so that learners can acquire the most critical components of writing. Assignments are developed and designed to assess these skills.

5. Process and Practice: Guide students to monitor their own learning progress by reviewing the writing process, their work, and feedback and assessments of and for their learning.

6. Feedback: Encourage rapid, evaluative feedback that encompasses many perspectives, providing detail, meaning, development, and action.

7.Timeliness: Facilitate inquiries, interactions, feedback, and formative and summative assessments such that they are usable, and initiated and responded to with a minimum of delay.

8. Availability: Make available to the learner as his or her schedule dictates all appropriate aspects of the course, instruction, and the learning community.

9. Tutoring and Remediation: Use a variety of flexible instructional practices and formative assessments to identify and support students who may need more time to acquire or demonstrate mastery of a skill or concept.

10. Flexibility: Approach course design and deadlines with the knowledge that changes to either or both might be needed to fully address the needs of the class and/or individual learners. Course designs can be adjusted to accommodate student needs.

11. Scalability: Support the attention available to each student such that it does not degrade as the number of students increases.

12. Evidence-based Decision Making: Foster the use of data that is relevant and actionable, supporting instruction, learning, and continuous improvement.

The Student Writing Process

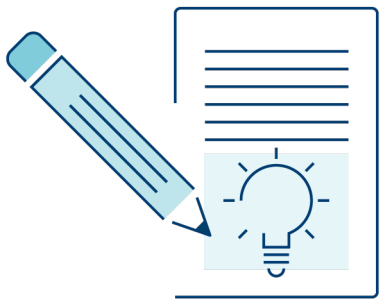
"We want to find tools beyond grammer checking - tools that facilitate learning about writing and improving writing."

(Workshop Participant)

In 2005, Carol Twigg noted that good pedagogy "lifts all boats,"[21] regardless of the modality or the tools used to support instruction and writing. In 2021, we know that this aspiration cannot be met by good pedagogy alone. The increase and sophistication of digital tools and teaching over the intervening years means focusing on specific feedback and specialized pedagogies that benefit and lift all learners—in individualized ways.

Using the list of digital-forward design principles, the second workshop session asked participants to follow the student through the writing process to identify the pain points, bottlenecks, and gaps in the current model and to describe the potential solutions—both pedagogical and digital—that might be employed to address the issue and alter current challenges.

The steps in the writing process used for the workshop were: prewriting, research, the first draft, revising, and editing and proofreading. Working through this 'student writing journey' participants used the digital-forward principles to guide their evaluation and to suggest strategies, tactics, and tools that could be incorporated into the writing course at that stage.



(WPA, 2019)

By the end of first-year composition, students should be able to:

- Develop a writing project through multiple drafts
- Develop flexible strategies for reading, drafting, reviewing, collaborating, revising, rewriting, rereading, and editing
- Use composing processes and tools as a means to discover and reconsider ideas
- Experience the collaborative and social aspects of writing processes
- Learn to give and to act on productive feedback to works in progress
- Adapt composing processes for a variety of technologies and modalities
- Reflect on the development of composing practices and how those practices influence their work

It's important to bear in mind two things in this section of the report: 1) not every writing assignment will follow these exact steps; and 2) the writing process is not as linear as these steps suggest. For example, there is a lot of opportunity for research during the pre-writing process described below as well as in the revising process. Nevertheless, these activities in the writing process allow us to understand the general requirements for creating a writing product.

Prewriting

Students will often struggle with the invention of their writing.

It's said that Mozart composed most of his works in his head before committing anything to paper. In a letter to his father, he once stated, "Everything's composed--just not written yet." While we do not expect all first-year writing students to be the Mozarts of composition, there is value in helping them to have a vision of their work before they begin to create it. They need to understand not only what the assignment is, but also why they are writing it and how they can bring their own experiences to bear.

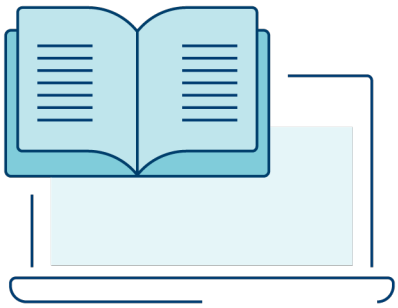
Certain digital tools and strategies can help in this process. For example, mind mapping and whiteboard tools such as Padlet, Miro, Mural, Mindmeister, and others can be used to help students sketch out what major points they wish to make in their writing. Instructors can use such tools with a backward-design approach, encouraging students to begin at the end: create a text box or insert a series of images that allow the student to express where they want to go. Then have them work backward to establish the steps that will help them get there, using lines and arrows to demonstrate how each point flows into another. There is also merit in having students experiment with visual representations of what they want to say, using digital whiteboards, creating collages, drawings, and so on (the equivalent of "mark making" in the art world[22]).

Secondly, there is the question of how we add structure to the prewriting process. That is, how do we devise questions and processes that help students think through what they are trying to accomplish? Students are not simply learning to write; they are learning to think critically, to evaluate research and arguments, to construct logical arguments, and to construct rhetorically effective responses to questions.

This is where access to an accompanying reader of example writing comes into play. The instructor might make available reflective papers, literature reviews, research papers, and templates that demonstrate how other writers have constructed their own writing. For example, students could be encouraged to identify an author's conclusion, and then sketch out how the author's previous points led to that conclusion, similar to the backward-design mind-mapping described above.

Prewriting Tools

- Stasis Theory helps to develop questions and ideas.
- Visual apps for creativity and whiteboarding, such as Padlet, Miro, Mural, Mindmeister, Prezi.
- GroupMe allows discussion for brainstorming ideas. FlipGrid allows for audio and video discussion.
- Blogger is a great way to have students reflect on the process and follow through on their writing. Changing something as simple as the platform where students are writing can change their engagement
- Kahoot for gathering student ideas, opinions
- Perusall allows for social annotation to help identify different parts of writing
- Learnosity helps to manage writing workload and provide feedback.
- Use speech-to-text to allow students to verbally compose their ideas.



Research

Research involves both getting a deeper understanding of the literature associated with a topic and collecting the most relevant sources that will inform and support a paper. These are infinitely broad, ranging from personal remembrances to scholarly articles. It can be difficult to know what to include, what to exclude, and why.

Students are encouraged to think about the literature as a conversation and their search for research as a quest where gathering some sources will inform their knowledge and help them to search for additional sources. While not every source will end up in the final writing assignment, keeping track of this conversation can help students to see the evolution of their research. A number of digital tools can help in this process, including, of course, the school library's search tools and research databases, as well as EndNote, Zotero, Cite This For Me, Evernote, and OneNote.

It is also important in the first-year writing course to emphasize a range of research sources, without limiting citations to peer-reviewed sources. An essay on current events, for example, will improve the student's understanding of news media sources as well as how to distinguish between fact and opinion pieces that are often presented side-by-side. (Sharing links to websites such as the News Literacy Project or NewseumED can help seed such discussions.)

One major bottleneck to consider in the research process is students finding themselves overwhelmed with usually overly-broad search terms that lead to an ocean of results further requiring keen filtering skills while also evaluating the legitimacy of sources. When discussing finding sources, it would be valuable to help students begin by narrowing their searches. In this situation, peers can often help each other to think through the variations on search terms that would be helpful, and in the digital-forward class, collaborative reading and discussion tools can facilitate this. Such tools include Perusall and Parlay.

A powerful strategy for managing research data, in preparation for the first draft, is to craft ideas, statements, quotations from research, etc. onto note cards and to try rearranging them to uncover the most effective way of communicating all the cards' information.The application Gingko is an example.

Mobile tools that allow students to work quickly, where they are, have special potential. For example, envision a micro/mobile tool that could allow students to collect such cards on their mobile devices no matter where or when an idea sparks. The instructor could even make an assignment out of this process, e.g., within the next 48 hours, have students add at least five ideas to their cards. Cardflow (iPadOS/Android) is one such application, though as of this writing, it is limited to tablets, not smartphones. SuperNotecard is a similar app for these kinds of tasks but does not yet have a mobile version.

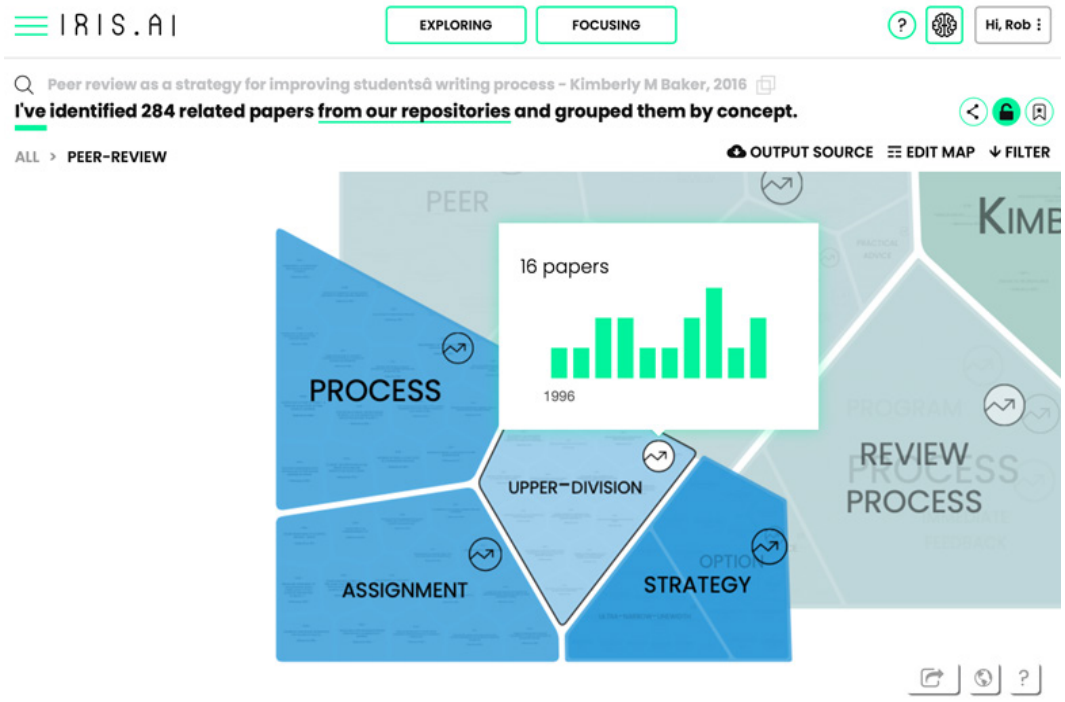
Tools like these can be immediately available to the student and, if incorporated into courseware or learning management software (LMS), can be so to instructors as well. Considering the immediacy and interactivity of the learning artifacts and activities presents an opportunity for application development and would also present a prime opportunity for gathering data on the student's thought process that

could be shared with instructors and/or teaching assistants. Imagine being able to see a timeline of the student's 'idea cards' as they researched a topic.

Additionally, there are digital "intelligent assistants" available to help with the research process. Iris.AI is available for organization or individual licensing as a tool that uses Natural Language Processing (NLP) to allow users to search dozens of research databases by stating their question in everyday language and then being presented with a "map" of potential sources.

On the horizon, IBM's Project Debater is using natural language understanding (NLU) to master the nuances and logic of persuasive arguments, allowing humans to craft better decisions in discussion with the AI. During the workshop, participants had presentations and discussions on the current use of AI to create chatbots that students can use to ask questions about a writing assignment. Justin Mays of Clayton State University presented on the LochBot that they are currently continuing to develop, which interfaces with IBM Watson to develop a dialog with students as they work through a writing assignment. Future iterations of such tools will likely be able to "discuss" with students their research questions and to help students formulate ideas and think critically about their topics.

Figure 1 - Iris.AI Digital Assistant



Research

As with the prewriting process, reading the works of others is key to understanding research. When working with peer-reviewed research in particular, there is value in having students explore existing peer-reviewed research as a class and learning the particular formats and styles that are used in various knowledge domains. Grouping students by prospective fields of study (social sciences, natural sciences, arts, humanities, etc.) can help them to focus on the research and writing norms where they are considering majors.

Lastly, as students build out their research, mind mapping tools such as those discussed in the previous section can be used to list sources, draw connections between and among them, and map out the logic in presenting what the students have found.

Tech Tool Shed

- Waymaker (Lumen) for access to OER and tracking progress
- Evernote
- OneNote (Microsoft)
- EndNote
- Zotero
- Cite This For Me
- Library digital search tools and research databases
- Perusall
- Use mind mapping platforms (listed above) to build a network map of the research, links to works cited
- Camtasia and other screen capture platforms for reflective capture of the writing. Ideally, this could even be embedded into the writing assignment
- Leverage more Natural Language Processing for searching
- Intelligent assistants as aids to research?
    - Could be built with rules to control for authenticity
    - IBM Debater as a high-end example

The First Draft

"The more students write, and the more feedback they get, the better their writing becomes."

(Workshop Participant)

Writing is a conversation, ultimately, between the writer and the reader. In first and early drafts, it is also between the writer and the topic. It is here that focus and perspective are refined or can be obscured and lost amongst the truculence of resources to align, a phrase to fit, or the vexing emergence of an alternative line of thought. For these and many reasons, as the workshop participants followed the student's writing journey through the first draft. The role of feedback took on an out-sized presence in the discoveries and deliberations.

Feedback is essential to the writing process. Instructors need to consider who the student is, where they are coming from in their writing, and what they bring to the table. Knowing how much to judge, to encourage, to direct, to leave for the student to discover—is the art of instruction. The most important feedback a student needs, throughout the writing process, is, "Am I doing this right?" "Am I going the right direction?" "Where do I go next?" Knowing these answers and tailoring them to the individual student with the right mix of critique and encouragement is the provenance and unique skill of the writing instructor.

One strategy to provide more opportunities for low-stakes feedback, owing to scaffolded learning models, is to break the writing process into segments (micro-learning) thus making more opportunities for incremental feedback as students develop their thesis, assertions, and conclusions. By breaking sections of a paper into individual assignments, students are encouraged to focus on each section at a time while providing the opportunity for feedback either from peers, the instructor, or through digital tools.

Wise and DeMars suggested that the act of providing feedback itself may be an effective motivator,[23] especially if that feedback has a cumulative effect as one section of the paper builds upon another. Workshop participants noted that it is challenging to motivate students to complete an assignment that is not a part of their grade.[24] Providing some sort of 'credit' for work on each element should be considered.

Key to feedback early in the writing process is that it be low-stakes, as immediate, and as actionable as possible. Here we see several opportunities where digital tools could change the instruction/time equation. First, incoming students are conditioned to 'trial-by-error' learning strategies through their use of technology in general, and in social media and gaming particularly. Trying something out, and getting immediate feedback, are more natural ways for them to learn than reading a manual or waiting for an instructor's response, which may be hours away.

Time is the single greatest constraint in writing instruction.
It takes time to read, comment, and inspire student writers, and it takes more time to tutor and guide under-prepared, struggling students. Rapid feedback on the writing process is valuable in having students quickly assess whether they are on the right track during the writing process. Students often have narrow study 'windows' when they can work productively. Working students may have as little as twenty minutes to study in a break. When colleges compress writing courses into five- and eight-week versions rapidity is even more essential—and consequential. Providing quick feedback on an assignment may be necessary to advance the writing process.

We assert that, due to the synchronous nature of the instructor-forward model, feedback is not as timely as it could be from the student's point of view. There is potential for automated communication to allow for feedback to students at times when the instructor is unavailable. Rubrics can help bring some measure of consistency and efficiency to the feedback process. This workshop asked, "How might we make communications more timely?"

Digital Forward Feedback
Today, the structural and operational challenges of students writing at different times, speeds, places distant from the instructor—and the limitations on feedback—are accepted as 'the way the class works.' Our workshop participants identified ways digital forward design could help rethink the way feedback works (and doesn't) now. Studies have shown that the closer feedback is given to an action, the more impact it has on future improvements. In an iterative, digital forward course, feedback should be given to the student as quickly as possible, so the student can maintain writing momentum. Digital tools already provide immediate feedback in adaptive courseware. Digital-forward design should construct feedback models where each feedback channel (digital, peers, instructors) is optimized to provide actionable responses. AI and machine learning will not (and should not) run the digital forward class. But they could perform basic formative assessment of mechanics, grammar, citations, etc., i.e., things a copy editor would do. Questions and final papers could then be passed along to the instructor for more higher-order feedback and summative grading.

Tools such as WriterKey and WriteToLearn can be incorporated into the course to allow for rapid feedback as each small chunk is written. Many instructors use tools such as Google Docs or have students swap papers through the LMS so that students can provide feedback to each other. Audio tools, e.g., speech-to-text, or a bot that can read students writing back to them, can help students visualize and reflect on their writing as they organize their thoughts. Technology should allow learners to chart their progress on a writing assignment so that it is possible to understand how well students incorporate feedback into their work. In-line text editors in the LMS that provide for tracking changes and for the evolution of the writing can also produce data for understanding student progress.

Knowing when to give feedback (responding to a request, submission, or data-indicated intervention), what feedback is needed, and how much is needed are the skills of a talented instructor. Technology needs to ensure that feedback is meaningful and that it is delivered in a meaningful way at a meaningful time. Our mantra: right time, right place, right learner. Digital-forward design should consider the size of activity a student is given before feedback. This 'micro-feedback' model uses

smaller, micro-learning chunks that provide more feedback opportunities and mini-scaffolding steps that are easier for under-prepared learners to meet and build a growth mindset. These will better fit smaller, mobile devices that students can use in short bursts between larger, longer laptop writing sessions. Finally, in discussions of AI for feedback, it's important to recognize that skilled writers do break rules from time to time, for example, using a sentence fragment to emphasize a point. An AI may not recognize the legitimacy of this.

In order to streamline the feedback process on the first draft, we recommend several applications that provide automated feedback to the student. Existing tools can make facilitating and sharing feedback easier (instructor-to-student and student-to-student). Eli Review and Peerceptiv are designed to help in this process. Details on these apps can be found in the following section on Revising. However, the student need not wait until the first draft is completed in order to make use of some of these tools. Many of them will analyze individual sentences and paragraphs as the student writes in order to provide instant feedback.

Tech Tool Shed

- Google Docs
- Microsoft Word
- Gingko - lets you shape your ideas with lists, outlines, and cards
- Learnosity helps to manage writing workload and provide feedback
- OnTopic
- VoiceThread for voice and video feedback.
- Use emojis in feedback to communicate affect
- WriteToLearn
- WriterKey
- MyWritingLab
- WritingMentor
- Ecree
- VisuWords for brainstorming vocabulary
- Possible tools that can identify the intent of an essay to address diverse categories of writing and different approaches to addressing them
- Tools that analyze the writing data (speed, errors) while the student is writing

Revising

"Is it the writing teacher's job to cover material or to uncover material?"

(Workshop Participant)

The real work of writing comes in the revising stage.

This is where students confront their ideas, judging them for clarity, coherence, and even relevance. Each student will sharpen his thesis and arguments as the whole paper evolves. In general, students do not like revising their work. Many learners find it difficult to make changes to first drafts, and the more work they have put in on the first draft, the more resistant they are to change. Pedagogically, it's important to make students aware that writing is an iterative/recursive process. Furthermore, it helps to remind them of this throughout the revising stage.

Essentially, when students are revising their writing, some might finish in two days, others in five days, and others maybe in two weeks. They will all require varied amounts of time to complete enough revisions to have a quality product. Is there a way to do this in the digital-forward model so that instructors aren't essentially having to juggle 30 students with 30 different due dates?

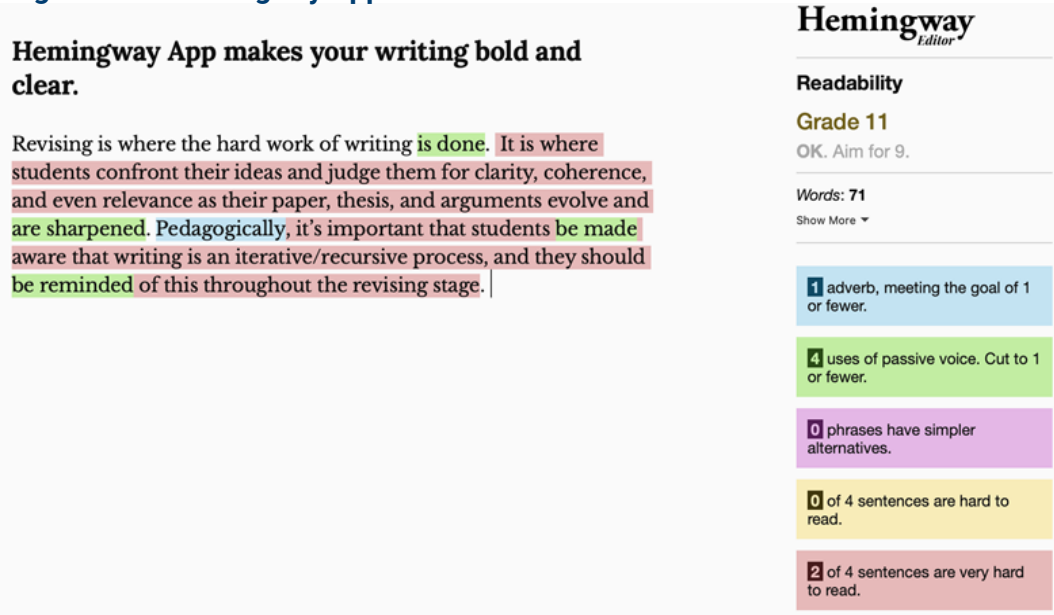
Students will enter and exit the revising process at different rates—some work more quickly, and some require more time to make necessary revisions to their work. This, again, is where digital tools can help. In the instructor-forward course, students must meet a certain deadline for revisions so that all drafts can be submitted to the instructor for feedback (and possibly grading). In the digital-forward course, we want to focus on equity, such that students who require additional time to meet the same level of mastery in their writing as other students will have it.

Most teachers grade in batches not just to streamline the grading process and keep the class on a similar instructional cycle from class to class, but also to accomplish some internal grade norming to ensure fairer assessment across the class. If this "batch" grading remains in your scenario, students can hand things in when ready, but instructor grading might happen all at once. No juggling needed. And with electronic submissions, the paper can sit for some time waiting to be graded. It may be that there are some assessment tools that could offer general feedback when any student submits a paper and that teacher review and directed feedback could be offered at a set time (a hybrid model).

In the ideal course students can work through all projects at their own pace and move on to the next as soon as they finish one. In an instructor-forward model, this creates grading issues, and instructional focus issues. One way around this in composition is portfolio grading. Using an 'emporium' model, students can be working on different projects, at different paces, throughout the term, getting revision help as needed and the final grading occurs at the end with all projects. Some papers might be revised once, but others might get attention and revision all semester. This allows students to work toward mastery all term at their own pace for the most part.

This is an opportunity for technological solutions to provide more iterative, timely feedback before the learner feels that their first draft is “done.” A tool like the Hemingway App can help with this process. Indeed, we plugged in our original draft of the opening paragraph in this section and received the following feedback from Hemingway:

Figure 2 - Hemmingway App



Tools like these can ‘unblock’ the student’s view that the paper is ‘good as it is’ by making suggestions that do not carry the weight of an instructor’s grade and provide an easy way to try out alternatives with immediate feedback.

Another strategy could be using a whole-semester model to a writing assignment. That is, when there are multiple assignments over the course of the semester, students tend to focus on getting each done so that they can move on to the next one. This doesn’t provide them time to reflect deeper on their writing for any one assignment. Using a whole-semester model, students can see that single assignment (broken into several stages) as it evolves over the course of the term. Here, we recommend using a course map designed with a mind mapping, diagramming, or whiteboard tool such as Miro, Mural, Mindmeister, Lucidchart, CourseTune, or Bubbl.us, though there are many others to choose from. Following basic instructional design principles, the instructor can start with learning outcomes and then map the readings, activities, and assignments to those outcomes visually. The instructor can then share the final product with students so that they can see how each stage of the whole-semester assignment relates and grows toward the completed product.

Again, it is important at this stage of the writing process to use a variety of feedback tools and tactics. In addition to digital tools for quick feedback, peers, tutors, and teaching assistants are also important—and there are digital tools to help organize their work. Peerceptiv, Eli Review, Eduflow, and PeerStudio provide a variety of tools to help share work products among groups of students, to markup

documents and provide comments, to use ratings scales to evaluate the quality of work, and to provide meta-cognitive training by allowing students to teach each other. Furthermore, one challenge that many students face in peer review is insecurity or embarrassment, either in sharing their own work or in feeling unqualified to review another's work (or both). Tools like Peerceptiv and Eli Review allow for anonymous reviewing to reduce such problems.

Meanwhile, students can get feedback from tutors by visiting sites such as Smarthinking, Wyzant and Tutor.com. Calendly and Appointlet are just two of a number of scheduling apps that would allow teaching assistants and instructors to schedule quick feedback meetings with students. These are in addition to enterprise applications that most campuses run on, like Microsoft Outlook/Office365 and Google's G Suite for Education.

Students will likely enter and exit the revising process at different rates -- some will work more quickly, and some will require more time to make necessary revisions to their work. In the instructor-forward course, students have defined deadlines when they can get feedback (and possibly grading) from an instructor. In the digital-forward course, we want to focus on equity, such that students who require additional time to meet the same level of mastery in their writing as other students will have it.

This is where digital tools can help in the revision process. Using simple tactics like versioning of drafts can help the student edit out thoughts that become superfluous as the writing is refined without the fear that the thoughts are lost. Tracking the time spent, quantity and types of changes, and other easily reportable actions made in the revision process can provide deeper insights into the drafting process of each individual. These insights enable instructors to be more targeted and precise in their interventions and tutoring.

We believe that design for, and incorporation of, more intelligent and actionable digital tools into the writing process will result in an increased emulation of the one-on-one tutoring experience—and success—that Bloom described in 1984.

To that end, as the student moves through the revising process, in addition to providing immediate, intelligent, actionable feedback to the student, these digital tools should constantly generate data to be analyzed and presented to the instructor. When the student submits her draft or final paper to the instructor, the paper and a dashboard summarizing the rich amount of process data individual to that student should be available so that the instructor can more quickly understand the student's writing journey and provide final, individualized feedback.

Tech Tool Shed

- Using different colored fonts/highlighting in writing software can show the writing process and how it evolves.
- TurnItIn Feedback Studio for providing feedback on writing assignments (in addition to the platform's text matching)
- Google Docs for collaborative writing/review
- AllenNLP for analyzing and parsing sentence structure
- Learnosity helps to manage writing workload and provide feedback
- Wyzant can help with tutoring
- Hemingway App analyzes writing for clarity
- DocuScope for computer-aided rhetorical analysis
- PeerStudio
- PeerGrade
- Eli Review is a pedagogical scaffolding tool that also teaches how to give feedback.
- SmarThinking, Wyzant and Tutor.com for tutoring
- EduFlow and Peerceptiv for collaborative peer review

Editing and Proofreading

"The use of any technology tools for writing should come with a caveat: students need to learn how to use these tools to their benefit and not simply rely on the tool to do the work for them."

(Workshop Participant)

When the instructor, teaching assistant, or tutor feels that each student has reached a satisfactory level of revision, it is time for editing and proofreading. At its most basic, this process is about conforming the writing to a set of rules and standards. At its most creative, it is knowing when, and which, rules to break.

It is in the editing and proofing processes that technology has been most successfully employed e.g. for rules-based tasks such as spelling, grammar, and plagiarism. The range of tools available at this stage reflects the different aspects of editing and proofing that need to be addressed. For example, tools like Grammarly and TurnItIn can help students identify whether they have overused quotes from outside sources. This should also be used as an opportunity to ensure that any words being used from another's writing are properly attributed to avoid plagiarism.

Tools that were listed in the research section above can also be used at this stage of the writing process for things like creating appropriate citations of research, for example, EndNote, Zotero, and Cite This For Me. Grammarly, Google Docs, and Microsoft Word provide necessary proofing for correct punctuation, spelling, and grammar, though students should be cautioned not to accept all grammar suggestions without checking them for clarity first.

Motivation

The editing and proofreading stage is a culmination of the previous activities. However, there is one major challenge that can trip students up: motivation. Students may feel overwhelmed by the editing and proofreading processes, especially with multiple iterations and drafts and the potential firehose of feedback being generated by the applications and approaches discussed above.

That is, when students have spent so much time on their first draft, and when it's likely that other assignments have been moved to the front burner, how can they be encouraged to bring up their previous draft and edit it? Additionally, how should the instructor determine how much revising and editing the student has done?

With current word processors, such as Microsoft Word and Google Docs, there are tools for tracking the students' changes and for seeing previous versions of the assignment. There are not, however, any robust analytics on how the paper has evolved over the course of writing. This is an opportunity for future application development, where the suggestions generated by tools such as Grammarly and Hemingway App, as well as from peer reviews, are tracked and changes made are cataloged. For

example, if Hemingway App suggests to the student that 13 sentences are hard to read the algorithm prompts the student to think about potential revisions. The application will ask how many of those sentences were revised and made easier to read? Such information could be presented to the instructor in a data dashboard that would provide one indication of the amount of learning the student has done.

One challenge that many new college writers face is understanding plagiarism and the proper use of source material. Tools such as TurnItIn are commonly thought of as plagiarism detectors. However, what they are really simply matching the text in a student's submitted paper or draft to a database of other papers, including both publications and papers that other students have submitted using the same tool. Such tools cannot distinguish, for example, between text that has been appropriately quoted and cited in a student's paper versus the same text presented as the student's own writing. Nevertheless, if a student uses TurnItIn or a similar tool during the drafting process, it can help them see how many passages they are taking from other sources and to understand where quotes, annotations, and/or citations need to be used.

Tech Tool Shed

- Grammarly, TurnItIn can help students identify overuse of quotes
- Hypothes.is for digital annotations
- Wyzant can help with tutoring
- Hemingway App analyzes writing for clarity
- OnTopic
- ETS Criterion writing evaluation service
- MyWritingLab

Additional Tech Tool Shed

Workshop participants discussed a few other applications that could assist in the writing process. For example, one simple yet prominent barrier to students getting assistance with their writing may simply be finding a time when they are able to visit their instructor (either in person or online, to work with each other/peers, with a tutor, or scheduling aspects of the complex writing and research process, dedicating time to the process. As mentioned previously, Calendly and Appointlet allow teaching assistants and instructors to schedule quick feedback meetings with students. Scheduler and Bookings are applications that can be plugged into the Microsoft Office365 environment to assist in scheduling.

Purdue OWL helps with searches, citations, drafting, revising, etc., and it now includes a beta version of Spanish-language pages that is growing. For addressing issues of accessibility and universal design, WebAIM contains a wealth of information on policies and practices across various documents and media formats as well as offering services and training. Lastly, students may benefit from learning to use certain tools for time tracking and project management, such as Pomodoro Tomato Timer, Toggl, and Trello. Students can enhance their self-awareness in the writing process by highlighting time spent, effort spent, and identifying wins and challenges.

Assessing Writing

"In multimodal writing, all types of communication generate data. Not just text, but images, videos, memes, etc. We're collecting it, but it's not captured in a way that we can analyze. Yet"

(Workshop Participant)

When the workshop began to explore how instructors assessed student writing, the true artistry of teaching and guiding became evident. Best described as 'getting to know the student' through their writing, it was here the dynamic between consistency of the performance bar students needed to meet, and individualization of the feedback and grading they received to get them there, became the most tortured.

A unanimous agreement confirmed that the quality of assessments cannot suffer in our quest to serve students better, to serve more students, or to provide more opportunities for writing within the course. Gratifyingly, ideas emerged around providing a more consistent assessment process that generates useful data and also allows the instructor to move more expeditiously through each student submission.

The Rise of Rubrics

Rubrics have become the tool of the moment in attempting to bring consistency and clarity to grading in just about any subject area. Given increased focus on accountability in postsecondary education, their use is on the rise. Rubrics attempt to systematize the analysis of writing into quantifiable criteria that can then be compiled into an aggregate score for grading. By employing a rubric tool in a Learning Management System, instructors can create clickable rubrics that allow them to quickly indicate each student's progress on each area of an assignment. This will also generate data that can be tracked and compared over time so that instructors can track student progress. Additionally, workshop participants emphasized the value of using multiple types of rubrics, and to use them early and often.

Rubric frameworks are much easier to digitize and hold much promise for automation. At the modest end, this could mean simply tallying scores for individual criteria into a composite, partial, or overall score for a paper. In the digital-forward writing course, instructors using rubrics can generate data to improve not only the writing process, but also curriculum and instruction. That is, if a rubric for an assignment is designed to capture progress toward one or more learning objectives, and if the data generated by using that rubric to assess a number of students shows that some objectives are not being met, then we know that something is amiss.

Rubrics can indicate where a student is on a continuum of quality criteria, for example, from novice to expert. Rubrics can make feedback on basic errors more efficient, for instance, in the mechanics of writing. Multiple types of rubrics used early and often will produce multiple data points across time to establish comparisons and allow faculty to track student progress.

Rubrics can help manage larger classes and make the assessment process more efficient. They can be especially valuable for novice instructors. Likewise, in schools where there are a great number of instructors, for example, a cadre of part-time lecturers, the use of rubrics across multiple sections of the course on the same writing assignment can improve equitable consistency and help department chairs identify if there are any gaps in instruction.

However, rubrics are not without their challenges. Lacking a personal touch, they can be less individualized. Rubrics may give the impression that every student is starting at the same point in their writing abilities, even when they're not. Improperly used, rubrics can make teaching seem like an assembly line and should never be seen as a catch-all for assessment.

As the workshop participants discussed at length, there needs to be a degree of consistency within the curriculum, but rubrics can also be limiting to faculty freedom. While freedom and diversity in content and assignments must be preserved, equity demands that the performance bar be the same for all students and there be a significant degree of consistency in assessments used to measure performance within a class and across all writing courses.

Innovation in Peer-review: Scaling Writing Pedagogy vs. Automating Assessment

by Michael Feldstein

Unfortunately, the trick of automating assessment in order to scale classes that is used across large swathes of the curriculum won't work well for writing, at least in the intermediate future. Machine learning and artificial intelligence methods for essay evaluation and feedback are unreliable at best. They are bad at handling writing from special populations who may have good quality of thought but very specific reasons for their writing errors, such as second-language learners or students with certain kinds of disabilities.

But that doesn't mean that we should give up on scaling high-quality teaching of writing. Rather, it means that we should reconsider our approach to scaling. Writing teachers today employ methods for increasing the amount of feedback their students get on their writing. These methods are group work and peer evaluation. While the research on peer evaluation is thin and uneven, there is some evidence to suggest that high-performing peer evaluations can provide students with feedback that approaches the quality of an expert educator. Training a student to be a good evaluator of writing will be easier, on average, than training an algorithm to do so. Equally importantly, the skill of critically evaluating a piece of writing—whether it is somebody else's writing or the student's own—is one of the core competency goals of writing classes. We can scale writing classes by scaling high-quality student peer review.

continued on following page

Innovation in Peer-review: Scaling Writing Pedagogy vs. Automating Assessment *(continued)*

Reliably training students to conduct quality peer reviews of writing is challenging even for expert educators in small classes. The process is usually scaffolded roughly as follows:

- The educator models assessment of writing for the class.
- The whole class practices assessment together in discussion, with the educator as facilitator.
- Student practice assessing each other's writing in groups.

This process is often run multiple times in a loop, working over different parts of the writing process or different aspects of writing.

All three of the above basic steps can be scaled and better scaffolded with technology. Certainly, social annotation and other collaborative learning tools enable whole-class conversations around the first two steps to scale. Several collaborative assessment tools have also been created, with a small and growing research base regarding their effectiveness. It's not hard to imagine analytics and machine learning techniques being applied not to provide feedback on the quality of students' writing but rather on the quality of their collaborations. Analytics exist today that can detect conversational moves such as affirmation, building on a previous statement, or counter-argument. Due to the fact that these algorithms are looking at conversational cues (e.g., "I agree" or "On the other hand"), they don't have to be trained on the writing or be able to evaluate the subject matter in order to be useful. By adding in analysis of conversational turn-taking or network analysis (i.e., who tends to reply to whom), we can imagine a rather robust system of technology-supported feedback and scaffolding that helps students to conduct more constructive conversations and provide more useful feedback to each other. Such a system of supports, particularly if it were embedded directly in the text that is being peer reviewed by the class or group, could enable a writing instructor to support more groups of students providing better feedback to each other on their writing. Rather than relying on machine learning to solve the scaling problem, the system is grounded in scaling an older but still highly effective system: human learning.

Thinking Beyond Rubrics

Just as rubrics generate data, workshop participants also discussed how each writing assignment itself is a form of data—text, images, videos, links to articles and websites, etc. are all data points that would be valuable in the data ecosystem described above. The ability to analyze such data will allow for future uses of natural language understanding and machine learning to assist in the feedback and assessment processes. Likewise, writing assignments and portfolios of student work could be generators of longitudinal data that can be reviewed by the student and instructor. Furthermore, as word processing applications and text editors evolve, the potential exists for using keystroke data to understand the evolution of each student's writing, to understand how sentence structure, parts of speech, adjective and adverb use and the like all change as the student becomes a more proficient writer.

Providing Feedback

This report has already spent a great deal of time discussing the process for providing feedback to the student writer in the drafting, revising, and proofreading processes. Once the assignment reaches the assessment phase, much of the feedback approach is the same. However, there are two additional points that workshop participants made specifically about the final assessment.

First, artificial intelligence (AI) and machine learning (ML) can be married with some rubrics, such as for mechanics, grammar, and citations, that can allow machines to take a first pass at assessing student writing. Participants discussed this process as being akin to something a copyeditor would do. This is not meant to be a replacement for the instructor, and instructors should not rely on the conclusions drawn by the AI. Just as writing instructors would advise students not to blindly accept all grammar suggestions made by Microsoft Word, we would advise instructors to consider the AI's suggestions in the larger context of the sentence, paragraph, or paper. AI cannot replicate the expertise of the instructor in seeing connections, reflections, and the evolution of writing, but it can accelerate the process by taking on more elemental tasks.

Second, there is more to assessment and feedback than just the paper. It is valuable, for example, for students to hear what their instructors have to say, more than just reading text. Tools that allow instructors to append audio feedback to an assignment will help students understand instructors' points of view as well as foster better teaching presence within the course. Furthermore, scheduling tools such as those described in the Additional Tech Tool Shed section above can expedite better synchronous discussion between the instructor and each student.

The Growth in Automated Scoring of Writing: Current State

by Peter Foltz

Over the past two decades, Automated Writing Evaluation (AWE) engines have been developed and deployed into wide use in a variety of educational and assessment contexts. These applications cover a range of use cases and users ranging from grade school to university level to professional certification for both formative and summative assessments. Automated writing assessments have been embedded within high-stakes testing contexts including K-12 state assessments, the GMAT, the GED, and certification tests. Similarly, automated writing assessment has become part of formative writing programs in K-12 and higher education via applications such as Writing Mentor®, WritetoLearn®, WriteLab, and PEGWriting®.

The increased research on and implementations of AWE systems is due to a convergence of factors in the availability of student writing in online formats, new AI-based methods, faster hardware for machine learning, and advances in measurement theory. It has also been driven by greater needs from educational institutions to measure students' writing performance in realistic contexts and to ensure students are receiving effective training in writing across the curriculum.

AWE systems have benefited from the rapid growth in AI methods applied to language similar to those seen in many commercial systems, such as Siri, Alexa, and machine translation systems. Through training on large samples of text– with sizes often in the thousands to millions – modern statistical and deep learning-based approaches have enabled methods of understanding the meaning expressed in student writing. The methods do not merely count surface features of language such as the number of nouns, grammar errors, or look for relevant keywords but, instead, can convert streams of language into accurate measures of construct-relevant characteristics such as semantic meaning, coherence, syntactical structure, and variations in word use. These features can provide the basis to characterize a rich set of writing abilities in students. Most systems use a machine learning-based approach to determine how to weigh those features to predict scores and feedback on essays. Research on AWE systems has shown that their scoring can be as accurate as human scorers.[25] [26]

Current systems have proven able to score a range of types of traits of writing such as quality of ideas, organization, appropriate use of writing conventions, sentence fluency, and word choice. Systems are also able to assess written responses for correctness of ideas and use of evidence. As such, these systems have been used in formative settings where the AWE can provide instantaneous feedback to students and support the teaching of writing. Students are able to write, submit, receive feedback, and revise essays multiple times over a class period to allow students to receive instant feedback on writing. These strategies have been used in cases where students may write multiple drafts with feed

continued on following page

The Growth in Automated Scoring of Writing: Current State
(continued)

back before submitting a final draft to the instructor. However, feedback in AWE systems are not yet able to provide the full level of feedback an instructor may be able to provide, e.g., suggesting on how to reorganize sections, evaluation of the quality of argumentation, commenting on creativity of ideas, honing messaging for a particular audience, or personalizing the feedback based on extensive knowledge of a student's learning history.

The Future of Automated Scoring

With continuing advances in research on AWE and further developments in natural language processing in AI, we anticipate that the systems will continue to improve in detecting and being able to give better feedback for additional kinds of writing. Over the next three to five years, we will see more advances in the ability to evaluate argumentation, give feedback on the quality of evidence, and potentially evaluate and comment on the quality of organization.

The technology for AWE was initially developed for high-stakes testing, but the greatest changes will come from approaches that support students and teachers for formative writing feedback. These will be available embedded within writing environments designed to support student writing while also allowing instructors to monitor student performance. Along with the increasing adoption of digital educational environments, there will also be new opportunities to leverage the data from student interactions. Such systems can monitor a student's portfolio of writing longitudinally to see changes in sophistication of writing, increased quality of vocabulary, and improvement in argumentation. Instructors can then access greater information about student writing growth as well as better understand where individual students are having difficulties in order to provide more personalized instruction.

Much of the focus will continue to move in a direction where these systems are designed to work in synergy with instructors to allow the computer to do what it does best, detect a large number of writing features quickly, and allow instructors to do what they do best, provide nuanced and more personalized feedback. For example, recent research[27] has shown promise of using AI-based active learning, that watches how an instructor grades and then in real time starts to work with the instructor to detect similar issues in other student papers. Overall, AWE systems are not designed to replace what an instructor does, but allows students to receive more timely feedback, while keeping an instructor in the loop, by alerting them to students that appear to be struggling and still letting them continue to support students with nuanced personalized writing feedback.

Design Recommendations

- Rubrics should be detailed enough to account for differences in the quality of students' work and to allow the student to discern why their grade is as it is. However, scales that are too small can be counterproductive. They may not help the student think critically about what needs improvement.
- Learning Management Systems (LMSs) should support rubric use with tools that make it easy to write the rubrics and to create clickable rubrics for grading. Machine learning might also reorder the comment bank in the rubric to prioritize feedback and make it quicker.
- It is also essential that the data generated by these rubrics be easy to analyze either within the LMS (dashboards) or as a data download that can be analyzed, e.g., in Excel. The easier the analysis process is for instructors, the more likely they are to use it.
- It may be helpful for faculty to work with psychometricians and other assessment specialists who can help to design assessments of writing that are accurate and reflective of the process.
- We should consider the evolving role of teachers. A writing assessment could first be automatically graded, passing along the suggested feedback for the instructor to then give more individualized feedback and share deeper knowledge with the student. Further, an emphasis on student agency is important in encouraging the student to use technology to review and improve their own writing.
- Writing across the curriculum: writing assignments could be assessed by a writing instructor for the quality of the writing and by a discipline-specific professor/SME for the content of the writing.
- Equity and access must be consistent in the process of selecting tools and designing courses. For students with limited access to devices or connectivity, the best tools in the world will still be useless.

Conclusions from the Workshop

"The future is already here - it's just not evenly distributed."

(Willimam Gibson 1993)[28]

As faculty, we fear that machines will take over the classroom. Yet, we embrace technology where it supports our best practices and advances our pedagogical agendas. In fact, the machines are already here. It is highly unlikely we will stop using word processing, spreadsheets, spelling and plagiarism checkers, learning management systems, and many more tools any time soon. Clearly, we are in the midst of what will be a decades-long progression of innovation, transformation (and, of course, reformation) that will challenge our most basic precepts about teaching and learning.

Throughout this evolution, reports like this one will serve as markers and guideposts, noting the advances, the incorporations, fretting about the losses, and heralding the coming of more change. That is exactly what this workshop in digital-forward design has done. We have seen new tools explored and incorporated into the instruction of writing. We have worried about how changes, both real and opined, will somehow diminish student learning and we have struggled to see the upside of 'guide on the side' transitions.

The workshop participants dug deeply into some of the most challenging obstacles and opportunities of instructing—and learning—how to write. In this brief time, they brought a number of issues and novel solutions to the fore. They validated our hypothesis that, like Gibson's future, many innovations we think are in the future are already here, they are just unevenly understood and applied. The participants persevered and described various themes through which change, and solutions, can be predicted and pursued. They consist of proven, proposed, and possible solutions and are meant to drive forward the design, practice, and innovation in instructional/learning models that are decidedly digital—and highly equitable.

Of course, the technology focus led, first and foremost, to identifying new (and new-ish) tools, such as mind mapping tools for prewriting, note taking tools for research, and writing tools like Hemingway. One goal of the workshop was uncovering and suggesting where these tools could be applied. But we also knew that using these tools would not alone be enough to achieve 2-Sigma increases in learning for writing students. Writing students, especially those who are inequitably prepared and/or time-challenged for any variety of reasons, will need:

- Flexible, changeable times they interact with the course materials, complete assignments, and meet deadlines
- More time to work on rudimentary, mechanics, and more writing in general to catch-up - and keep up with their peers
- Rapid feedback to stay on track when they are not in the classroom or cannot ask their professor

Humanizing Online Teaching to Equitize Higher Education

Most essential to learning for inequitably prepared students is a sense of confidence that they can achieve and reach, with work, the same level of ability as students who benefitted from better previous instruction. The digital forward design in writing courses will build on several streams of proven success. The mindset work done in entry-level courses by the University System of Georgia and the Motivate Lab at the University of Virginia, the peer-review model described by Michael Feldstein, the student support work of PelotonU, and the work of Ryan Baker at the University of Pennsylvania are examples of the research and proven practice the project will employ.

The workshop described a digital-forward course as leveraging technology to accommodate a spectrum of learner types, backgrounds, and skill levels. It identified the necessity of changing existing 'equal opportunity timelines' into equitable achievement models for students of all skill levels. Workshop participants underscored inclusive models and measures to ensure an open and engaging instructional environment.

This will mean changes in the way instructors teach. In their paper, Pacansky-Brock et al., 2020[29] argued that we must shift from placing the onus on students to make these adjustments to one where instructors recognize the barriers inherent in their own teaching and course design. This process, say the authors, allows us to "humanize" digital-forward courses; online courses should no longer be seen as being on auto-pilot, but rather should be designed to facilitate engagements between faculty and students. They also identified issues of equity, diversity, and inclusion in online courses that have traditionally placed minoritized, low-income, and first-generation students at a disadvantage. The authors described college courses wherein student engagement and academic achievement are taken as a given and that all learners either must have baseline qualities where they can succeed or must learn to acquire those qualities quickly.

Improving student success at institutions with high percentages of Black, Latinx, low-income, first generation, and other inequitably prepared populations will require writing courses that leverage technology that works with digital-forward instruction. Guidelines like the Peralta Online Equity Rubric[30] point out the hard work ahead as digital-forward designers are challenged by equity criteria including:

- Addressing students' access to technology and different types of support (both academic and non-academic)
- Increasing the visibility of the instructor's commitment to inclusion
- Addressing common forms of bias (e.g., image and representation bias, interaction bias)
- Helping students make connections (e.g., between course topics and their lives, with the other students)
- Following universal design for learning principles[31]

An APLU PLC study found that "...adaptive courseware adoption provides the opportunity to make learning more active for students. Rather than content delivery through a lecture during class time,

content can be delivered by the courseware so that class time can be repurposed for active learning."[32] Pressing further into digital-forward possibilities, the potential for interactions built around intelligent agents was identified in the workshop as significant. While nascent now, these tools are poised to move from service chatbots to consultative, and even guiding, partners to humans in a wide range of endeavors.

Build in Instrumentation for Lesson-level Telemetry and Analysis

While the use of digital data in teaching is still in its infancy, the use of observational data is not. Instructors have always used their observations to adjust and focus their methods and the models for the courses they teach. The evolution of the course, based on feedback, is an essential expectation and skill of the instructor. We are approaching an inflection point in both the type and amounts of data that instructors will work with.

The technology tools we use for teaching, and those students use for learning, generate a great volume of data which, if designed and used effectively, can provide impactful insights into the instruction—and learning—of good writing. We are undergoing an astonishing growth in the digital data available to an instructor through resources like the LMS and adaptive courseware. This digital data can be very useful. Tracking log-ins to the LMS can identify students who have stalled or are ghosting the course - and interventions can be triggered more immediately than from weekly, in-class, roll-calls. "For instructors, the use of data provided by adaptive courseware allows for modification of instruction and course activities to meet the needs of students in every course meeting…"[33]

Achieving effective levels of technology-supported learning, and thus achieving greater equitable opportunities for inequitably-prepared students, requires far more data than writing courses currently produce. This data must be machine readable, detailed, robust, actionable, and shareable.

One innovation cited by the University of Maryland, Baltimore County was the creation of a "data warehouse," collecting students' grades, courses, extracurriculars, and demographic information from across the institution to provide a comprehensive view of the student experience. This database allows leadership, staff, and faculty to examine the efficacy of and to reshape programs to meet student needs. It also lends insights on how and when to help individual students.[34]

To dramatically increase the levels of data produced will require tools designed to produce and share more digital information than they do today. IMS Global's Caliper standard provides a language by which more finely-grained learning activities can be captured, reported, and shared among other tools. Currently, when students use adaptive courseware, they work within the courseware's domain with little data, if any, data passed back to the learning management software (LMS). Similarly, data from tools like Grammarly and TurnitIn are lost.

Throughout instructional design, a range of data collection methods can be employed to evaluate the tools and strategies individually, as well as the course as a whole. Once the digital-forward tools have been established for the course, work can be done with the vendors of those tools to establish protocols for their sharing of user data. This could include clickstream data, numbers of logins, and length of time spent interacting with the tools -- each as a measure of student engagement with the

tool. These data points will allow us to establish how much students used the tools and the paths that they took in getting from start to finish. Time series analysis would allow us to compare equity students with a control group for comparison of how far each progresses in using these tools throughout the course. (E.g., to determine if equity students' use of the tools outpaces that of the control group.) Information can also be collected from student surveys and focus groups with a sample of students on their experiences with the course. Likewise, surveys and either interviews or focus groups with instructors would be vital in helping us to understand the challenges and benefits of teaching in this digital-forward domain.

Text is a form of data and should be treated as such. The ability to analyze text data will allow for future uses of natural language processing and machine learning to assist in the assessment process. Here essay and text analysis tools could be embedded into the LMS. Students will likely use any of the common word processing apps for their first draft: Microsoft Word, Google Docs, Apple Pages, etc. However, we also envision the possibility of a word processing tool integrated into an online course gathering keystroke data on students as they write to help them, and the instructor, to identify challenges and understand how their writing evolves.

Furthermore, consider that discussions, writing assignments, and portfolios could be thought of as generators of longitudinal data that can be reviewed by the student and instructor. A lot of data generation is going to depend on which LMS is in use. Schools should consider their data needs and work with their LMS provider to establish useful data practices. Data collection should adhere to standards, e.g., IMS Caliper, so that it can be shared easily with users and across platforms.

While improved instrumentation must increase the flow of data within and across the tools used in a writing course, it must also increase the shareability of data across course sections, across faculty, and across terms. The data generated by a digitally-instrumented course would inform two key activities. It would provide immediately informative/actionable information for the instructor, such as identifying a stalled student in need of intervention or the validity of assessment questions on a test. Secondly, the data would provide effectiveness assessments that inform continuous improvement of the course, efficacy of the course design across multiple sections and instructors, and other institutional research and improvement efforts.

Connecting data from individual students into class-level evidence and course-level intelligence creates shareable, actionable insights at the course, department, and college levels. An analysis of data of writing courses can illuminate any inequities or diversity issues across composition courses. It would answer questions such as, are minority students disproportionately represented in online courses versus face-to-face courses (or vice versa)? If so, program administrators can determine if they need to provide special attention to meeting the needs of students in one modality or the other.

Scoring and Grading

While summative assessment is and should remain the role of the instructor, we believe there are a number of technologies that could assist in the summative assessment process. Significant improvements to this process could include reducing the time-lag between submission and return of assignments but increasing the detail of feedback in a grading report.

It is important to differentiate between on-demand feedback and on-demand grading. Digital-forward design should have on-demand feedback possibly in tiers. Tier 1 feedback would be immediate, technology-assisted using existing tools like Grammarly, Hemingway, TurnItIn, etc. and novel/new tools like automated rubrics and text-analysis essay-scoring. These would all feed progress data to both the student and the instructor. Tier 2 would be peer-based feedback and Tier 3 would be instructor-based.

On-demand grading could be at two levels. Formative grading would be at specific points in the term, with summative grading at the completion. Students could accumulate a number of formative 'grades' as they progress, e.g., peer reviews, rubric scores, and instructor feedback, that would give them actionable feedback and send progress tracking information to the instructor. In final grading, all of the data input might be considered as a portion of the final grade for 'progress towards a final paper' so students are recompensed for using the digital and peer feedback tiers. Throughout this process an intelligent agent could be used to help remind the student of the status of their work.

The goal is not to replace instructors; rather, such technology would provide the baseline support that students need in the immediate term to help them continue their writing. Such tools also generate tremendous amounts of data that, with the proper analytics and instrumentation, can give instructors a better sense of each student's writing journey when the instructor enters the feedback/grading point in the process.

Mobile & Micro Learning

Two challenges among the underserved population of college students are study and homework sessions that are generally briefer and done in more diverse locations—such as on breaks at work. For these reasons, we recommend that a digital-forward writing course of the future would utilize both technology-based solutions using mobile phone-based tools and pedagogical alterations of micro, small-learning tactics.

Mobile applications might include review cards generated from adaptive courseware that a student could review at convenient moments or dictation apps to capture and compile fleeting thoughts into a set of brainstorming prompts to be referenced in a longer session later. Designing lectures and assignments to be viewed and done in smaller chunks, e.g., work break-sized 15-minute sessions would fit both student time restraints and cognitive attention theory. These tools also provide the capability of incorporating intelligent agents into the writing support process.

Digital forward design, using intelligent feedback tools, can alleviate the constraint of conventional response times by providing formative (not summative) feedback to students using alternative feedback resources including intelligent agents, adaptive, and content analysis tools. Feedback from these tools does now, and will increasingly, enable learners to continue writing unabated in diverse study windows, to write more overall, and thus to improve more within the bounds of the conventional term.

Would this work in practice? Identifying the elements of the course that are dependent on the student's and the instructor's schedules and availability for feedback and interactions are essential parts of designing a digital-forward course. For example, in an instructor-forward course an instructor might commit to responding to student inquiries within 24 hours or return an assignment with comments in

a week. AI may need to be able to ask leading questions during pre-writing and revising stages without being prescriptive.

Individualizing instruction not only addresses the type of feedback the student needs, but also the timeliness of that feedback. In a digital-forward course, an intelligent agent could respond to student questions immediately, 24x7, and an essay scoring application could respond to a submission within seconds. While there are doubtless questions about the educated insights these technological solutions can provide (currently), the fact that they can provide feedback when it is needed, e.g., at 10:00 p.m. to a working student, their value may balance out an excellent answer one hour or twelve hours later, with an immediate, and good enough, answer when the student needs it.

Workshop participants identified two foci for developers as digital-forward feedback design progresses. The first is immediacy. Immediacy is critical as the closer feedback is to the work reviewed the more effective and usable it is for the learner. Students most in need of instructor support benefit greatly from immediate, actionable feedback. Immediacy is an implicit concept of instruction. In Bloom's 1:1 tutor model, the student and instructor are in the same place and time—where their communication was immediate. Instructors can emulate immediacy with continuous/partial presence in the classroom—but they cannot be with, or immediately respond to, every student's writing needs beyond the class and campus walls. Online instructor-forward models struggle even more to make interactions immediate.

The second focus was on availability. Availability is important for students who study at irregular times or who need more time and feedback. Instructors cannot be expected to be available 24x7, but the variety of students' schedules and personal lives requires feedback on more than a 9-to-5 schedule. This presents an opportunity for technology to support the instructor. Automated feedback tools, such as those described in the revising section, are a good start. There is also tremendous promise for AI-based chatbots that can help students to think through everything from framing a research question to writing a thesis statement.

Recommendations

A wife talks to her home's virtual assistant. "Turn on the TV, please." The TV turns on. "Thank you," says the wife. This prompts her husband to ask, "Why did you say 'please' and 'thank you' to the machine?" "Because, the wife replies, "when the machines take over - they will remember."

(Urban Legend)

Regardless of why some students enter their first college writing course inequitably prepared, they need more time, and attention, to master college-level writing than other students. This special attention takes time—time that is not budgeted for, and simply not available in sufficient amounts in an instructor-forward course. We are in the midst of an inflection where technology can change the time equation for both writing instructors and students. Digital-forward thinking, course design, and teaching leverages technology to change the constraints we have come to accept as immutable rules and limits.

This digital forward workshop affirmed, deepened, and extended our contention that using a digital forward lens for design would bring new perspectives and potential solutions to some of the most vexing issues of the instruction of college-level writing. Specifically, the participants underscored the need, and described the means, for:

- Increasing the engagement of learners and instructors in online environments
- Finding and using slack time in conventional course designs for students to write more, and more productively
- Increasing the amount of useful data generated in a course to levels needed to make analytical tools effective and their output accurate and actionable
- Empowering individualized learning at scale that achieves the 2-Sigma goal of student success.

Additionally, we believe tools that assist in that process, like those for mind-mapping, brainstorming, and note-taking can capture and keep personal thoughts and insights more explicitly evident and front-of-mind over the course of a writing assignment and the course. Further, we believe that structured collaborations, such as the peer-to-peer model proposed by Feldstein, workshop-style approaches, or the team-based learning (TBL) model, especially those where interactions can be supported by technology, promise ways to keep the student productively engaged in the writing process, and with the writing instructor.

The Principles for Digital Forward Design

From this workshop we have advanced the Principles of Digital-forward Design to set a vision, guide practitioners, and advance the discussion and development of instruction that is more equitable, digital, and effective. The questions we ask include: What would learning look like if you used technology to make these principles achievable? What does the role of the instructor look like? How will students react? Will pedagogies and processes change? Will we see new roles to support digital forward courses?

The Digital-Forward Instructor

First and foremost, writing instructors are, and will continue to be, writing instructors. With all this focus on technology, it is all too easy to imagine instructors accepting judgements made by machines while they monitor digital performance gauges. Nothing would seem farther from the truth. Technologies, for the foreseeable future, will supplement and support, rather than supplant, the roles of expert practitioners.

That instructor roles and responsibilities will increasingly be integrated with technology is also (and already) self-evident. That these tools allow us to rethink the limitations of time and provide timely interactions for both learners and instructors seems eminently probable—and necessary.

Because we are inured to the instructor-centric mode, we view the limitations described in this report as 'the way things are.' In the digital forward model, we see these as opportunities to design learning the way it should be. Currently the availability, immediacy, and scale of instructional capability are defined in instructor-centric terms. Feedback is available when the instructor is available, within the instructor's timeframe, and by how many students an instructor can respond to. In a digital-forward model, these limitations become opportunities that are defined with a student-centric lens. On-demand feedback means feedback as soon as any student needs it, but with an instructor involved and managing the process.

In addition to a healthy skepticism of the value and use of new tools, the key traits of the digital forward writing instructor include: being open-minded; flexible; adaptable; not afraid of failure; ready to "let go" of processes that are no longer serving the students; and ready to turn over some roles to the technology as well as to the students. The digital-forward instructor is a conductor orchestrating the learning process; a curator choosing the materials students engage with and the directions they explore; and a coach, mentoring and encouraging the student's learning process and progress.

So, while a digital forward instructional model does not propose 'replacing' the instructor, it does identify routine roles where technology can take the lead. Instructors excel at engagement, interactions, and mentoring. Technology excels at availability, immediacy, and scale. A successful digital-forward course model would optimize the balance between instructor and technology supported solutions to student learning challenges.

Dealing with Stress and Motivation

The Personalized Learning Consortium found that "instructors must be equipped to monitor the data and analytics provided by the courseware, understand what the data is telling them about student performance and needs, and adapt instruction accordingly."[35] We have identified many technologies and

tools available now, and those rapidly emerging, that can assist in providing formative feedback on student writing. This results in intelligent assistance for the learner and actionable insights for the instructor, though there is a learning curve in using new digital tools that instructors will want to address early.

Initially, digital-forward courses will be challenging for students, as well as instructors. Writing classes set up as orchestral ecosystems will have tools and pedagogy working together. Students will need to be aware of, and trained in, the processes and tools they use. And they will need to understand the big picture of their journey through the course. The stress of their "dialogue" with technology throughout the writing process can cause frustration if not attentively monitored and managed by the instructor. Effective use of class time, informative resources, and intelligent agents provide multiple means by which interventions can be triggered. Several workshop participants discussed the value in a "division of labor" in learning new tools, for example, that certain students could be assigned a tool (such as a mind mapping tool) to learn and then teach it to others in the class. The college library and librarians are another valuable resource for students. There are many tools available for collaboration in writing and for marking up documents, providing comments, etc. Still, these can be clunky and much more complicated than simply writing on a paper. Tech needs to embrace hand-written markups of writing.

Change the Workflows: Taking promising technologies and pedagogies to scale

How might technology bring scalability to the currently unscalable? To increase writing possibilities, opportunities, and assignments in an instructor-forward course would require greatly more time from the instructor to review multiple drafts on multiple assignments and provide feedback. In the digital-forward course, more writing is possible when the instructor relies more on technology to support learning and to provide timely feedback that can increase or maintain students' momentum. Providing templates and/or rubrics to help instructors provide feedback can help with scalability (efficiency at current ratios). These tools should be used along with increasing use of master course models to ensure consistency of instruction across large numbers of full-time and adjunct instructors.

Adding insights derived from digital data to existing observational experience will be "a shift for many faculty, and it requires training and practice."[36] Furthermore, scaling the writing course does not necessarily mean more students per section taught. Rather, one of the most critical aspects of learning to write is, simply, to write more and often, and to receive consistent and timely feedback as drafts are written.

How do we ensure that scalability does not hurt the quality of learning? How do we ensure that scalability is not about cost-cutting or efficiency, but instead that it is about improving learning?

A significant finding of the workshop was a needed pivot from a product-driven design (viewing each writing assignment as a final, gradable 'product') to a process-driven design where the writing journey and progress are emphasized and graded in addition to the outcome. The paradox was not lost on the workshop participants that a process-driven approach, while addressing each student individually, exponentially increases the complexity and data to be managed. Indeed, it was exactly this koan that argued for more technology and analysis. Building in frequent feedback points across multiple sources (self-assessment, peer-to-peer, teaching assistant feedback, instructor feedback) is paramount.

Rise of the Learning Analyst

Just as instructors did not become teachers because of their love of learning management systems or providing technical support to their students, few of them are likely to develop a love of data science and the increased data a highly instrumented course will produce. It is here we see the emergence, in addition to the instructional designer who creates the course, of the learning analyst. In fact, the current role of the instructional designer is proof that, as course design complexity increases, specialized individuals are needed, and we predict the Learning Analyst will be the next role to emerge as a necessary professional. We see this role/skill set as essential to instrumenting, analyzing, and leveraging learning-level data into actionable and course improving recommendations. The need for analytical capability, combining data science with learning science, will continue to grow as adoption of tools like adaptive courseware, intelligent agents, and content analysis applications increase. We believe additional team members, like learning analysts, will organically evolve new instructional processes and workflows that will maximize the instructor's ability to 'know,' in very different as well as conventional ways, how their students are doing.

The Digital-Forward Principles: Taking promising technologies and pedagogies to practice

We have discussed in this report the value of, and need for, increased learner agency, empowerment, and ownership of the work; relying on students to learn and teach these tools is a major step in that direction.

Current AI for assessing writing is insufficient. It simply cannot understand context, tone, when to break the rules, etc. Feldstein tells us that deep learning algorithms may get there eventually; but a prominent worry in that process is that the AI may get to a point where humans don't even understand how the AI is operating.

In the classic sense of crossing Moore's chasms, instructional practice lags behind what is possible, which lags behind the emergent, and behind what is imaginable. Today, there are digital technologies that can move the needle on a range of measures of student success. It is the goal of this workshop to identify and consider these nascent, emergent, and imaginable possibilities as if they existed today, and integrate them with today's best practices. While we are likely many years away from advancements that let machines pose challenging questions or customize rubrics for each student, there is no question that this is where research and developments are going. With this uncertain future ahead, it is useful to construct models that envision the possibilities and perils of these advances.

Here is what we do know.

Time matters. The more time students have to write, the more their writing can improve. For working, inequitably prepared, and underserved students, more time is hard, if not impossible, to find in current writing courses. Digital forward design can give students on-demand feedback and instructors automated assessment tools that reduce time-delays, keep students writing, and avert stalls or stops.

Feedback matters. While feedback that is 'good enough' when the student needs it can be better than perfect feedback hours later, instructors are still essential. A tiered response model, where Tier 1 is spelling, grammar, plagiarism checking, Tier 2 is adaptive and intelligent feedback, and Tier 3 is the instructor, can address both the timeliness of the feedback, and its quality.

Data matters. Without the ability to calculate and communicate, success in postsecondary education is impaired, and nearly impossible. It is time to incorporate the benefits of digital forward courseware, proven in mathematics and other sciences, into the pedagogies of college-level writing. Technologies, both existing and emergent, are available for integration.

Digital transformations are coming. Ignorance has not proven a successful option when it comes to technologically driven change. Institutions, instructors, and students alike need to develop approaches that identify, assess, and adopt tools, services, and resources that improve their digital forward capabilities. Faculty and administrators need to take bold steps now toward digital-forward learning not only because it can increase performance and equity now, but also because doing so will flatten the learning curve as emergent technologies make their way into the marketplace.

Students are the reason. While faculty are, and should remain, the arbiters of writing instruction, no course is successful where the students are not successful. Digital forward brings both promise for improved performance and the perils of potential inequities, biases, and barriers for students. Such concerns must not be the reasons that block experiments, but rather the ones that inform and improve them.

Instructors are the future. Regardless of how technology changes the domain of composition, we see no world in which there is not a human instructor. Effective programs will consider the wide range of experiences and comfort with technology, making accommodations for everyone from the early adopters to the resistors. As new digital-forward designs continue to be developed , writing programs must emphasize professional development, not just on tech tools, but also on digital-forward pedagogy.

Your choices will define the future.

Appendix

PRINCIPLES FOR DIGITAL-FORWARD DESIGN

And the criteria by which to measure them.

Equity

PRINCIPLE: The design prioritizes accessible, inclusive learning environments that provide support relative to each student's level of need, and every student can get the instruction and support needed to achieve mastery of the learning objectives.

Measuring Equity: The proposed criteria for designing, measuring, and achieving equity in digital-forward design include ensuring:

- All students have access to technology (devices, internet access, and software) regardless of their ability to pay.
- All instructors have a visible commitment to inclusion.
- Universal design principles are emphasized in course design.
- Accessible, inclusive learning environments that focus on the racial outcomes of learners are prioritized.
- Intentional and authentic design brings traditionally excluded individuals, those with diverse perspectives and backgrounds, specifically by race-based and socioeconomic status groups, into processes and activities that share decision making power.
- Voices and agency of learners from minoritized communities specifically, African American/Black, LatinX, Indigenous/Native American, Asian American, Pacific Islander and Southeast Asian, and Alaskan Native populations, as well as first-generation and Pell-grant-eligible students, are contributors to the creation of classroom content and supports.

Engagement

PRINCIPLE: Foster connections among students, instructors, and content that inspire, motivate, and promote progress in learning through relevant support of learner experiences, agency, metacognitive reflection, planning, and actions.

Measuring Engagement: The proposed criteria for designing, measuring, and achieving engagement in digital-forward design include ensuring:

- Each course is an instructor-inspired, learner-focused journey into writing.
- Connections are developed and fostered among students, between students and the instructor, and between students and the instructional content.
- Students are seen as their own valuable resource. Every student is a contributing expert in some way.
- Learners are empowered and supported through self-regulation strategies.
- Assignments excite imagination and inspire performance. Low-stakes assignments encourage learner participation and reflection without fear of compromising grades.
- Personal experiences, metacognitive reflection, planning, and action are incorporated.
- A community of practice that prepares students to learn.

Interaction

PRINCIPLE: Facilitate both instructor- and student-initiated activities and communications that are dialogic, generative, and actionable.

Measuring Interaction: The proposed criteria for designing, measuring, and achieving interaction in digital-forward design include ensuring:

- Interaction happens among students, between students and the instructor, and between students and educational resources.
- Student interactions are collaborative.
- Technology curtails barriers for students. For example, all technologies employed are easily and intuitively accessed by users and integrated into a simple user interface (UI)
- Identifies and measures connections to content and to students and instructors to identify stalls, struggles, and at-risk behaviors
- Technology-initiated interactions are grounded in dialogue and are reproducible.

Instruction

PRINCIPLE: Use multi-directional approaches to sharing foundational course knowledge so that learners can acquire the most critical components of writing. Assignments are developed and designed to assess these skills.

Measuring Instruction: The proposed criteria for designing, measuring, and achieving effective instruction in digital-forward design include ensuring that it will:

- Democratize the learning process as learners progress from personal writing to public writing to scholarly writing.
- Meet students where they are to ensure those who need more time to learn can catch up and keep up.
- Use self-diagnosis and low-stakes assignments with opportunity for positive feedback and prescriptive suggestions
- Employ foundational course knowledge so that learners can acquire the most critical components of writing.

Process & Practice

PRINCIPLE: Guide students to monitor their own learning progress by reviewing the writing process, their work, and feedback and assessments of and for their learning.

Measuring Process and Practice: The proposed criteria for designing, measuring, and achieving efficient and effective processes and practices in digital-forward design include ensuring:

- The writing process is broken down into manageable stages, and students are provided with scaffolding and embedded guidance in the assignments
- Students can monitor their learning progress by processing/addressing familiar-but-evolving rubric criteria and feedback through their own writing
- Formative assessment quizzes with automatic feedback are continuously available to allow for reinforcement of concepts with which students are struggling
- Flexible scheduling of learning and assessments allow students to proceed at a pace consistent with their individual development of writing skills
- Alternative assessment strategies provide flexibility and avoid non-productive recursive homework loops.
- Students who need additional help can access a co-requisite course with tutoring and/or more supervision and support.

Feedback

PRINCIPLE: Encourage rapid, evaluative feedback that encompasses many perspectives, providing detail, meaning, development, and action.

Measuring Feedback: The proposed criteria for designing, measuring, and achieving efficient and effective feedback in digital-forward design include ensuring:

- Clear appraisals of performance are descriptive and reference specific learning goals, including guidance on next steps.
- Feedback identifies and measures productivity and progress of the student to identify stalls, struggles, and at-risk behaviors as early as possible
- Strengths are recognized and rewarded while deficits are identified and remediated.
- Detailed rubrics and prompts for individual assignments help students understand assignment objectives and how to improve, and assist faculty in evaluating performance.

Timeliness

PRINCIPLE: Facilitate inquiries, interactions, feedback, and formative and summative assessments such that they are usable, and initiated and responded to with a minimum of delay.

Measuring Timeliness: The proposed criteria for designing, measuring, and achieving timeliness in digital-forward design include ensuring:

- Digital scoring enables rapid turnaround of graded assignments. There must be high confidence in the efficacy of digital scoring.
- Assessment tools offer for personalized feedback within a reasonable time frame.
- Synchronous/collaborative documents allow for quick feedback.
- Peer review, on-demand tutoring centers, and/or instructional assistants facilitate the democratization of feedback to reduce the burden on instructors.
- Digital scheduling is available to streamline the process of scheduling tutoring and feedback sessions.

Availability

PRINCIPLE: Make available to the learner as his or her schedule dictates all appropriate aspects of the course, instruction, and the learning community.

Measuring Availability: The proposed criteria for designing, measuring, and achieving availability in digital-forward design include ensuring:

- Learning resources are designed to be on-demand and asynchronous as needed to accommodate student schedules.
- Tools, resources, and instruction follow the student across courses.
- The needs of the learner drive adaptive release of materials.
- The learning community (communication from instructor, student success teams, and fellow students) is responsive within a reasonable time frame.

Tutoring and Remediation

PRINCIPLE: Use a variety of flexible instructional practices and formative assessments to identify and support students who may need more time to acquire or demonstrate mastery of a skill or concept.

Measuring Tutoring and Remediation: The proposed criteria for designing, measuring the efficiency and effectiveness of tutoring and remediation in digital-forward design include ensuring:

- Student challenges and at-risk behaviors are identified early on for prompt intervention by technology, instructor, and/or student success team
- Formative assessments are low stakes (do not count toward the student's grade) and are turned around quickly to allow the student to change course rapidly.
- A variety of instructional strategies, tools, and learning objects are available to provide the right resources to the right students at the right time.
- Instructional design is leveraged to present all needed resources without overwhelming instructors and students.
- Learning strategies emphasize the writing process and provide revision opportunities.

Flexibility

PRINCIPLE: Approach course design and deadlines with the knowledge that changes to either or both might be needed to fully address the needs of the class and/or individual learners. Course designs can be adjusted to accommodate student needs.

Measuring Flexibility: Proposed criteria for designing, measuring, and optimizing the flexibility in digital-forward design include ensuring:

- Learning strategies emphasize context, individuation, and the writing process.
- Instructional design balances the learning timeline of the individual with that of the whole class.
- A hybrid design accommodates a range of modalities between classroom and online delivery.
- Materials are transparent -- instructors have access to all materials -- and released on a flexible timeline depending on each student's progress in the writing journey.
- Instructional style is conversational so students can easily and comfortably share their needs.
- Materials are ADA and IDEA compliant.

Scalability

PRINCIPLE: Support the attention available to each student such that it does not degrade as the number of students increases.

Measuring Scalability: The proposed criteria for designing, measuring, and optimizing the scalability in digital-forward design include ensuring:

- Courses are restructured to include peer review as a critical component.
- Students are taught to provide critical, productive feedback for peer review.
- Adaptive AI courseware is leveraged to provide automated feedback to large numbers of students. Instructors and students must have confidence in the efficacy of the AI courseware.

Evidence-based Decision Making

PRINCIPLE: Foster the use of data that is relevant and actionable, supporting instruction, learning, and continuous improvement.

Measuring Evidence-based Decision Making: Proposed criteria for designing, measuring, and optimizing the evidence-based decision making in digital-forward design include ensuring:

- Selected data points and tools are driven by research.
- Data collected is aimed at supporting previously articulated, measurable objectives.
- The collection of artifacts for data models is driven by the program's current and previous students. In other words, data samples must reflect the institution's students.
- Data is aggregated across multiple tools within the course and across the program.
- Dashboard design is driven by learning science with the goal of making information actionable.
- Writing assessments are screened, e.g., for reading level and grade recommendation prior to instructors' review.
- Data conforms to/supports standards, e.g., Caliper Analytics standard and tools from the IMS Global Learning Consortium.

End Notes

1. Barefoot, Betsy O, “Killer Courses: Understanding and Overcoming Roadblocks to First-Year Academic Success and Retention,” (Gardner Institute for Excellence in Undergraduate Education, 2013).

2. Ibid.

3. Smith Jaggars, Shanna, “Democratization of Education for Whom? Online Learning and Educational Equity,” in Diversity & Democracy (Association of American Colleges & Universities, 2011).

4. Espinosa, Lorelle L., Jonathan M. Turk, Morgan Taylor, Hollie M. Chessman, “Race and Ethnicity: A Status Report,” (American Council on Education, 2019).

5. No author, “Reducing DFW Rates: A Look at Course Completion,” Academic Performance Solutions (EAB, 2018).

6. Hrabowski III, F. A., Henderson, P.H., Tracy, K, “Higher Education Should Lead the Efforts to Reverse Structural Racism,” The Atlantic (Oct. 24, 2020).

7. Ran, Florence X., and Yuxin Lin, “The Effects of Corequisite Remediation: Evidence From a Statewide Reform in Tennessee” (New York: Community College Research Center, Columbia University, Working Paper No. 115, November 2019).

8. Ran and Lin, 2019, ii.

9. Bloom, Benjamin, “The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring,” Educational Researcher (Vol. 13, No. 6, Jun. - Jul., 1984, pp.4-16).

10. https://www.youtube.com/watch?v=VtvjbmoDx-I

11. Bloom, 1984.

12. Dua, André Jonathan Law, Ted Rounsaville, and Nadia Viswanath, Reimagining Higher Education in the United States, (McKinsey & Company, Oct. 26, 2020).

13. Columbus, Louis, “What’s New In Gartner’s Hype Cycle For Emerging Technologies,” Forbes (Aug 23, 2020).

14. The Carnegie Unit: A Century-Old Standard in a Changing Education Landscape January 2015|Written by Elena Silva, Taylor White, and Thomas Toch

15. Anthony P. Carnevale and Nicole Smith | 2018, Balancing Work And Learning, Implications for Low-Income Students. Georgetown Center on Education and the Workforce, Retrieved at: https://1gyhoq479ufd3yna29x7ubjn-wpengine.netdna-ssl.com/wp-content/uploads/Low-Income-Working-Learners-FR.pdf.

16. https://en.wikipedia.org/wiki/Moravec%27s_paradox

17. Vignare, Karen, Emily Lammers Cole, T. Buchan, Megan Tesene, Johannes DeGruyter, D. Carter, R. Luke, P. O'Sullivan, K. Berg, D. Johnson, S. Kruse, A Guide for Implementing Adaptive Courseware: From Planning Through Scaling (Association of Public and Land-grant Universities and Every Learner Everywhere, 2018).

18. Neelakantan, Shailaja, "Colleges See Equity Success with Adaptive Technologies," EdTech, November 25, 2019.

19. Cage, John, Marshall McLuhan: The Man and His Message, eds. George Sanderson and Frank McDonald (Golden, Colorado: Fulcrum, 1988), 219.

20. No author, WPA Outcomes Statement for First-Year Composition (3.0) (WPA Council, July 17, 2014). http://wpacouncil.org/aws/CWPA/pt/sd/news_article/243055/_PARENT/layout_details/false.

21. Twigg, Carol A. Increasing Success for Underserved Students: Redesigning Introductory Courses. (Saratoga Springs, NY: National Center for Academic Transformation, 2005). https://www.thencat.org/Monographs/IncSuccess.pdf.

22. https://www.tate.org.uk/art/student-resource/exam-help/mark-making

23. Wise, Steven L., & Christine E. DeMars, "Low Examinee Effort in Low-Stakes Assessment: Problems and Potential Solutions," Educational Assessment, 10:1, 1-17, 2005. DOI: 10.1207/s15326977ea1001_1.

24. See, e.g., Kornhauser, Z., Jillian Minahan, Karen Siedlecki, & Jeffrey T. Steedle, "A Strategy for Increasing Student Motivation on Low-Stakes Assessments," paper presented at the 2014 conference of the American Educational Research Association, that found that neither giving students a sense of shared responsibility nor appealing to their academic citizenship had a statistically significant, positive effect on motivation to complete a low-stakes standardized assessment. https://www.researchgate.net/publication/314151364_A_Strategy_for_Increasing_Student_Motivation_on_Low-Stakes_Assessments

25. Shermis, M.D. and J. Burstein, Handbook of Automated Essay Evaluation: Current Applications and New Directions. (Routledge, 2013).

26. Yan, D., A.A. Rupp, & P.W. Foltz, (Eds.). Handbook of automated scoring: Theory into practice. (CRC Press, 2020).

27. Hellman, S., M. Rosenstein, A. Gorman, W. Murray, L. Becker, A. Baikadi, ... & P.W. Foltz (2019, June). "Scaling Up Writing in the Curriculum: Batch Mode Active Learning for Automated Essay Scoring." Proceedings of the Sixth (2019) ACM Conference on Learning@ Scale (June 2019) 1-10.

28. Pacansky-Brock, Michelle, Michael Smedshammer, and Kim Vincent-Layton, "Humanizing online teaching to equitize higher education," Current Issues in Education, 21(2), (2020).

29. "Science Fiction Writer William Gibson," Fresh Air (NPR, Aug. 31, 1993).

30. Peralta Community College District. "Peralta Online Equity Rubric, version 3.0" [Creative Commons license: BY-SA], Retrieved August 26, 2021 from https://web.peralta.edu/de/peralta-online-equity-initiative/equity/.

End Notes

31. Stark, Inger, “Peralta Equity Rubric,” (Online Learning Consortium, 2019). https://secure.onlinelearningconsortium.org/effective_practices/peralta-equity-rubric .

32. Vignare, et al., 2018.

32. Ibid.

33. Ibid.

34. Hrabowski III, F.A., et al., 2020.

35. Vignare, et al., 2018.

36. Ibid.