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Knowing Who's on Your Team: Pedagogical Expertise and the Impact on Software Design

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Abstract

Striving to solve specific pedagogical problems with specific technologies is crucial to student learning. In a search for a tool that worked well for digital peer reviews in writing and public health courses, we discovered one that provided the space for peer review. The initial purpose of the project was to consider how a specific digital peer review tool impacted our pedagogical approaches to teaching the review process. The project relies on instructor reflections regarding the uses and impacts of this tool on their peer review pedagogy. It was concluded that educational technology tools created by subject matter experts have a positive impact on the improvement of the specific pedagogical processes for which the tool is created.

Keywords:

Eli Review, Pedagogy, Peer Review, Subject Matter Expert, User-Centered

Digital technologies wear many hats. They are used to create programs that follow algorithms and embody a wide scope of communicative activities. Educators use digital technologies for a vast array of purposes, from online quizzes to providing cyber-arenas for discourse between students and their teachers. These diverse applications of technology in education have sparked an ongoing debate between those who understand digital technologies as a socially-mediated set of culturally-defined practices and those who perceive them as neutral tools to be developed and used by humans in culturally non-specific ways (see Archer, 2006; Feenberg, 2012; Harris & Greer, 2016; Mina, 2019; Paesani, 2016). Hinrichsen and Coombs (2014) observe a "consistent tension between perceptions of technology as either neutral or culturally situated, along with the implications each view has for policy, practice and curriculum" (p. 2). This acknowledgment that technology impacts educational policy, a generally undisputed claim, lends further support to the idea that technology itself is far from neutral.

This lack of neutrality can shape pedagogies in ways that can be problematic or ground breaking. As instructors find, select, and implement new technologies in their classrooms, it is important to reflect on how our adoption and use of tools impacts that pedagogy. Understanding the purpose of the tool is critical to reflection at the adoption stage. When educators cannot find a tool that is purposefully designed for their pedagogical problem, they must creatively adapt tools outside of their purpose.

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These limits shape pedagogies, but imagine what using a tool designed with educator users in mind would be like.

Who's on First: Technology, Agency, and Bias

Technology impacts the way that tasks are performed across all professions, with the goal of making our work more effective (Ertmer & Ottenbreit-Leftwich, 2010; Zuboff, 1988). For educators, this means using technologies in ways that improve teaching and learning. As new technologies have rapidly replaced old ones in today's educational landscape, teachers must regularly update their skill sets to perform as global citizens of multicultural digital environments (Daher & Lazarevic, 2014). Mishra and Koehler (2006) argue that "intelligent pedagogical uses of technology require the development of a complex, situated form of knowledge" in which teachers simultaneously integrate what they know about technology, pedagogy, and the content they are teaching. Unfortunately, though, many software programs used in schools are poorly designed for an educational setting, which further compounds the problem of teacher implementation (Mishra et al., 2007).

When selecting instructional technologies, educators and researchers alike agree that we need to choose the tools that will help us to solve a problem in the classroom and that we need to pay close attention to the impact of those technologies on our pedagogy (Darby & Lang, 2019; Kirsch, et al, 2016; Marlow et al., 2009; Selfe, 1999). Focusing on problem solving ensures that technology is not just being used for the sake of using new technology. It means that the technology selection and adoption criteria are focused upon a pedagogical problem. However, it is easy to forget that the software applications we use are designed by other people, and sometimes those people are not designing with sound pedagogical practices in mind.

Sometimes, the lack of pedagogical knowledge is because these creators are not subject matter experts (SMEs) in education (McGee & Ericsson, 2002). Working with software designed by people who lack formal training in pedagogy, especially the pedagogy of a specific field or discipline, often means that, as educators, we are required to creatively consider how we can make the technology work within our existing pedagogical practices. In other words, we ask ourselves, 'how can we adapt this tool to be useful in our own classrooms to solve our problems?' Instead of simply using a tool, we often transform some aspect of our teaching to use the tool effectively.

Arguably, course design is *never* a neutral process (e.g, Blumberg, 2009; Hannafin & Hill, 2002; Wiggins & McTighe, 2005), and current software used in educational settings often follows a model which places the instructor, rather than the student, at the center of instruction, reinstating the "teacher-centered space of the traditional physical classroom" (Harris & Greer, 2017, p. 47). Harris and Greer argue that, in order to transfer the power back to the student, instructional software should be developed by subject matter experts (SMEs). Much of the software used in today's classrooms, however, is produced for stakeholders in corporate, rather than educational, environments. These software developers are less likely to consider the student-centered model, which is valued in educational settings, nor are they likely to consider the multifaceted demands placed on the teacher to integrate a certain digital tool into their course-specific content and pedagogical approach. In this paper, we argue that software designed especially *for* educators *by* experts in education will improve the teaching and learning experience. This claim is based on our experiences integrating a peer review technology designed by SMEs to make the peer review process easier in our classrooms.

As educators, we want our technologies to be part of the learning cycle instead of merely a vehicle for the consumption of technology and information (e.g., Ertmer & Ottenbreit-Leftwich, 2010; Zuboff, 1988). This focus on learning means the technology needs to help students explore, invent, and/or apply a concept or skill. Technology, from this perspective, is integrated into the learning cycle rather than the other way around, which brings us to the current struggle. There is a need for us to guide students to solve problems, but when we are forced to adapt the tools we already use to solve our pedagogical problems, how are we ensuring that the tools give us the space to guide students? How does this set teachers up differently than the corporate models, where students are consumers rather than problem-solvers? To engage students in the learning process, instructors need to question the cultural bias implicit in the technologies that are available (Selfe, 1999). We need

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to question the tool's purpose, our purpose, and how the two work together (or against each other) to guide active student learning.

What's on Second: Software Design, Command, Control, & Education

The original purpose of the tools we use is important because that purpose defines the tool's creation. The story of technology, its inherent biases, and how we use it to teach writing can be traced back to the mid-twentieth century in the U.S. military. The US military has had a great influence on educational objectives and research since the World Wars, and the military prerogatives of technological innovation, command, and control systems have influenced higher education through education research, artificial intelligence, cognitive science, and instructional design (Noble, 1991). For example, in the 50s, 60s, and 70s, the military's need for automation and semi-automation led to advancing AI, with the help of cognitive sciences, with the goal of the computer and humans working together in a system (Noble, 1991). Fast forward to 2016, and meet Jill Watson. She is Georgia Tech's AI online graduate assistant; essentially, she is a bot who answers frequently asked questions (Eicher et al., 2018). However, Jill shows the bias in her programming by responding quite differently to male and female students who indicate they would soon be parents (Eicher et al., 2018, p. 90). This does not mean these applications are not useful, they are game changing, but they are flawed as a result of the original intended purpose and context: automation within the military.

The influence of corporate America on higher education also has long been problematic because it impacts the higher education model and argues for very specific "job" related skills as the focus of higher education (Giroux, 1999; Yoshimura, 2008). These arguments will not be addressed here; however, considering the proliferation of technology (which is developed and sold by technology companies) in our culture, it is important to consider the impact of those corporations on our education spaces. Students are required to type papers, use email addresses hosted by specific companies, and access course content online in proprietary learning management systems. Education-based conference exhibit halls have more technology companies than they did ten years ago, but that does not mean they are pedagogically-driven technologies. Educational technology in the areas of testing, assessment, course delivery, content delivery, content creation, etc., are mainly developed by for-profit corporations (Picciano & Spring, 2013). Both military and corporate influencers of educational technology have the same shortcoming: the initial intended users are not educators or learners and the initial, or current, primary purpose is not learning.

I Don't Know's on Third: User-Centered Design, Iterative Design Practices, Subject Matter Experts

The influence of military and corporate sectors on educational technology in higher education includes a focus on user-centered design. However, the user is different across those three spaces. In higher education, learner-centered pedagogy is considered best practice because of the need for education to be individualized (Meyer et al., 2014); we also practice iterative design by taking learner experiences into consideration to continually improve our practices and spaces (Baldeón et al., 2018; Eby & Lukes 2017). The learner-centered shift in higher education can be paralleled with the private sector and military sector ideas of user-centered design (Altay, 2014; Noble 1991).

While military values and learning philosophies shaped much of the technology in the mid-20th century, the integration of semi-automation meant that the "user" (military personnel) needed to play some role in the research of these programs. For example, the Air Force needed to consider the "human-computer interaction" that was taking place between their pilots and the new control systems in their jets (Zuboff, 1988). Drawing connections between the learner/user brings up problematic images of corporatization and militarization of higher ed, and our technologies typically come from the military-influenced private sector, where they are defining and catering to specific users. However, military personnel and corporate users are very different users than higher education instructors, and the need to focus on the intended user of a program remains paramount to selecting a technology.

Why Left Field: Focusing on the Pedagogical Problem

After considering the purpose and intended user of

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the technologies, we need to focus on the problem we are solving. Our established problem in selecting a new technology is the teaching and learning of peer review to support student writing (e.g., Henry & Ledbetter, 2011). We were largely frustrated by the lack of options for robust peer review within our LMS. Beyond using the discussion boards, there was no way to really prompt students to interact with their peers' work in meaningful ways. We found ourselves relying on collaborative word processing tools like Google Docs for peer reviews. At our institution, one of the most widely used tools among students, faculty, and staff is the Google Workspace, which is adopted and supported by our institution. However, Google Docs was not created for the specific purpose of the graded online peer review. The intended user is much more capacious than that. One of Google's key strategies is "related diversification," which means that their products are targeted to incredibly broad and general audiences (Finkle, 2012).

Google's quest to diversify their products perhaps amplified their appeal to a broader range of users, which resulted in the widespread use of Google Docs in the field of education (Moore, 2016). However, despite its popularity, Google Docs were subject to criticism from users within specific academic writing contexts. The lack of defined structure proved challenging for both teachers and students to keep track of each student's contribution to collaborative documents (Al-Samarraie & Saeed, 2018; Zhou et al., 2012). Additionally, students worried that classmates could negatively impact their work through unregulated collaboration (Blau & Caspi, 2009). This tool, while useful, was not targeted specifically to the academic writing context.

At our institution, we also had access to PeerMark, which is a peer editing tool and part of the Turnitin platform (TurnItIn, n.d.). When first developed by graduate teaching assistants, the goal of the PeerMark was to engage students in the course, with one another, and to help students better understand what an "A-paper looks like" (Rivero, 2010). PeerMark allows instructors to assign free response and scale questions and the number of papers to review (TurnItIn, n.d.). After peer review is completed, they are able to review feedback on their papers that they can use to improve their future work (TurnItIn, n.d.). Although PeerMark claims to follow user-centered design practices and the user appears to be the student, it is still missing important pieces to support the student user. The program is lacking areas for student reflection on feedback and student planning on how to utilize the feedback, which are critical steps in effective peer review (Kieft et al., 2007; Sommers, 1980). This suggests that the user should be those teaching the processes as well as those completing the process.

As we were searching for a new tool, Critique'It was a program some of us had heard of and used before at prior institutions. Critique'It is an online review program that allows for audio, video, and text-based comments on a variety of types of work and, as stated by co-founder Alexa Fleur on the (now-removed) Critique'It website, follows user-centered design. However, the intended users are, again, the reviewers, not instructors trying to use a specific pedagogical tool for a specific pedagogical purpose (like peer review). The lack of expertise in facilitating/teaching peer review is evident in the lack of tools for guiding the reviewers or for reviewees to process the reviews.

Because we Center SMEs: Putting the "Special" in Specialists

There is much to be said for the humanistic, self-critical use of instructional technology in the writing classroom (Selfe, 1999). Selfe reminds us that we, as teachers, need to become more critical users of technology, which involves developing a deeper awareness of how "technology is inextricably linked to literacy and literacy education" (p. 414). Selfe warned against developing an "overly narrow" version of literary practices, and she urges "composition specialists," rather than corporate or government entities, to lead the development of a "diverse range of literacy practices and values" (p. 430). Similarly, Klein and Duffey (2009) claim the need for writing studies specialists to be consulted and part of the decision-making process when adopting institution-wide technologies to support writing instruction. Composition specialists, with their humanities-based training, offer a unique perspective on literacy, education, and society at large. Thus, they should be part of the teams that navigate the adoption of digital technologies in courses that require writing.

When teachers become critical users of technology, they operate with the newfound agency to design digital

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learning experiences. For some, the necessity of this critical inquiry into what our technologies do, what they support, how they impact us, our classrooms and our students, has raised the question of whether or not everyone should learn to code these programs—'code or be coded.' For example, some argue against the use of design templates as they take away agency (Arola, 2010). Learning management systems, and other teaching technologies used online and in classrooms are built as templates; the platform and design template is chosen *for* the users (Arola, 2010). Educators add learning objectives, content, and assignments to designated areas, to complete the learning environment. Though the idea of template-driven technology is not going anywhere, a technology that is designed with the pedagogical framework in mind will greatly benefit the instructors and learners. We are not arguing that SMEs should all learn to code, but rather that more SMEs should be on the development team for pedagogy-specific technologies.

Eli Review up to Bat!

After pushing technologies like the Google Suite, PeerMark, and Critique'It to their perceived limits in our classrooms, we found, when searching for a technology to facilitate peer review, that we, as teachers of peer review, were not the intended users. The technologies we used were not tools for teaching peer review and building trust between reviewers (Crisp & Bonk, 2018). Rather, they had different goals and different users in mind. The users of the first applications we adopted did not necessarily need to monitor and grade comments, keep track of revisions and timestamps, show that they valued peer review, encourage student agency in being student reviewers, or align activities with learning outcomes. While such goals may be possible to accomplish using these tools, teachers are often challenged to alter their own systems and practices to make the tool "fit" the curriculum. It was not always a natural or harmonious process. After a bit of searching, we discovered Eli Review, which had, seemingly, been developed for use by experts in teaching peer review who had witnessed instructional technologies from our vantage point, as teachers of peer review.

Tomorrow's Pitching: Culturally Nuanced Technologies and Teacher Impact

In comparison to the other tools presented in this paper, Eli Review was created by writing studies experts with experience in studying the impact of peer review and the importance of feedback and revision to the writing process (Eli Review, n.d.b). Jeff Grabill, Bill Hart-Davidson, and Mike McLeod, who followed evidence-based practices while creating Eli Review, were all faculty in the Writing, Rhetoric, & American Cultures department at Michigan State University and researchers in the Writing in Digital Environments Research Center (Eli Review, n.d.a). Additionally, the builders of Eli Review are writing teachers "frustrated" by a lack of tools to support their teaching of peer review (Eli Review, n.d.b). As teachers, they have designed a technology that prompts other educators to revisit their peer review pedagogy in ways that improve the teaching and learning of feedback and revision.

Thus, in the fall of 2018, we (four higher education instructors) piloted the use of Eli Review in a total of 6 courses. We created a quick reflection template for ourselves to use at the beginning of the process. When we started the process, in our reflections on why we were implementing Eli Review, we largely were trying this new program in order to improve our pedagogy in a variety of courses, projects, and spaces (including writing, online, multimodal, and nutritional science). One of us reflected on our frustration with "the lack of an easy way to facilitate peer review in the online setting. I enjoy using technology to humanize the course and allow for similar interactions that occur in a traditional classroom setting." Another within our group explained her motivation to explore how Eli supports student engagement while making "students accountable for considering and integrating peer comments into their revisions."

To summarize our collective reflections, we each wanted a tool that we could use to scaffold the peer review and revision process while developing an atmosphere of collaboration among our students. We wanted to make it easier to navigate the often surprisingly complex task of facilitating peer review activities while simultaneously humanizing online learning.

How Eli Review Works

Eli Review has what they call a review cycle that includes four stages. First, students post their written

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assignments to the program. Next, students practice giving and receiving feedback within peer review groups, which can be set by the instructor or randomly generated. After that, each student is required to craft a revision plan based on the feedback they have received from their peers. Finally, they resubmit their revised work. These stages are referred to as "writing task," "review task," "revision tasks," and "resubmit tasks," respectively. Each review task has specific "response types." These response types include:

- Trait identification, which involves instructor established traits that students check off for the work they are reviewing;
- Rating scales, which involves the instructor writing a statement or question and asking students to respond on an instructor defined scale of 1-25 stars (e.g., On a scale of 1-10, how clear is the research question?);
- Likert scales, which involves the instructor writing a statement or question and asking students to respond with a specific, instructor written, response select (e.g., The student work is properly formatted in APA style: Strongly Agree, etc.);
- Contextual comments, which involves the instructor asking students to write open-ended text responses to specific pieces of the work that is being reviewed; and
- Final comments, which involves the instructor asking students to provide final, overall thoughts about the work.

How We Used Eli Review

After we piloted the program in our courses, we individually spent some time reflecting on the ways we used the tool and the impact of the tool on our teaching. All four of us tied our use of Eli Review to at least one major composition (text-based or multimodal) in their course. After the course ended, two of us designed a reflection tool as a space for the four of us to reflect on our use of Eli Review and to comment on the required student engagement in their courses (adapting questions from the Faculty Survey of Student Engagement). We also collected student survey information, but it was for internal assessment for the institutionally supported pilot, and so not IRB approved.

In our responses, we agreed that Eli Review was easy to use and that it helped us to give students better, and more specific, feedback. There was also a shift in perceived value from less useful to more useful (even for the writing studies scholars among us). Eli Review allowed us to provide more targeted feedback criteria and questions for the students, and it allowed us as instructors to endorse review comments and give feedback on the revision plan. While that can also happen in other programs, Eli Review allowed students to see it all on one screen. For students doing digital peer review, that can be very important (not having to click back and forth between a list of questions in the LMS and the document they are looking at). It also helps ensure they are not missing any elements in the review. More importantly, we anecdotally felt that Eli Review allowed our students to start thinking about what to do with all the feedback they received. The revision plan task guided them to pull the feedback they felt was most useful in their revision process and discuss the value of the feedback and how they might revise their work based on that feedback.

Collectively, we identified more global changes to our pedagogy, such as building in more scaffolding steps during assignment development. While we always scaffold technologies and major assignments, Eli Review's functionalities pointed us to spaces within our scaffolding that needed further breakdown and structure. As one of us noted,

> "Using Eli Review prompted me to consider different types of ways I could utilize peer review in the course, using the different types of prompts available in Eli Review including the rating and Likert scales. This availability of different types of rating/evaluation opens up the possible types of feedback I can ask students to provide to each other."

In our fully online accelerated courses, we heavily scaffolded the technology and therefore use of the program, which made teaching peer review a larger focus in the class. This resulted in more peer review opportunities and methods made for more peer

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contact—more ways for students to easily interact with one others' content. The combination of more peer review assignments with better designed peer review assignments lead to our perception of "students being more comfortable with giving the reviews. Students were initially hesitant, as they often are, about peer review, but providing more structure and indicating that giving better peer reviews and learning what to do with the ones that were received as a goal of the course, students were more receptive."

We also identified specific ways our peer review pedagogy was impacted that align with good peer review pedagogy practices (Søndergaard & Mulder, 2012). We gave students more concrete, specific, and defined grading criteria, which then also impacted our rubrics. Specifically, the "trait identification" function in Eli Review prompted us to identify and clearly articulate observable and measurable aspects that students should be producing in their writing. Peer reviews were also better organized because they allowed for a single, streamlined space for students to do their work and potentially provide better reviews. This was not a change we actually needed to make, but instead was a built-in benefit to the program.

We also discovered, through the process of observing our students as they moved through the peer review and revision process, that the Eli Review tool supported personal responsibility and accountability in our students. We surmised that this may have been because "it recorded everything - timestamps, who said what, rate of completion, etc." Having all of this metadata in one screen made it easy for students to track their own progress, as well as their peer review partners' progress.

Some of us also leaned heavily upon Eli Review's built-in resources for new ways of describing what should happen in a peer review, and we began to consider other ways to more actively improve the peer-review process. Finally, Eli Review provided built-in space for students to easily process and synthesize the feedback they received, for both written and multimodal texts. In one class, students reviewed both traditional alphabetic texts (proposals for their multimedia projects) as well as the multimedia projects themselves.

Although the argument could be made that all of these built-in features limited teacher agency, a counterpoint is that they were designed by writing teachers, for writing teachers; thus, they suited the intended context, and perhaps this is why we perceived them as more facilitative than restrictive. Finally, Eli Review prompted us to reconsider what and how we were asking students to focus on their peers' work. Throughout the semester-long trial period, we used Eli Review to prepare our students to complete major projects, collaborate with each other, and scaffold their writing process.

Today's Catching: What We Learned

We set out to solve the pedagogical problem of peer review in digital spaces and found the Eli Review program solved other problems. We found that the technologies available to us were not providing us space for meaningful peer review and that our own pedagogy was positively impacted by implementing this program. We solved the problems of fostering and sustaining meaningful peer review and feedback, specific instruction and tools for providing that feedback, and showing students that we value peer feedback. Eli Review allowed/forced us toward these solutions with their resources, review task options, and limited instructor interaction. These are the benefits of using a program designed for a specific task to be executed by a precise group of users, and created by experts that are well informed about the best practices for that specific task and those users.

We also learned that digital tools developed by SMEs for specific user populations can support the agency of both teachers and students. Teachers who facilitate the use of these tools are equipped with a set of templates and processes suited to their educational contexts. This liberates them to deliver meaningful peer review activities for the writing assignment of their choice, instead of spending precious preparation hours tweaking activities which use tools that do not align as seamlessly with their pedagogical goals. It also emboldens teachers who lack coding skills, or the motivation to learn those skills, to use high-quality digital tools effectively and efficiently in their own classrooms. The "design of the space shapes understanding" (Arola, 2010, p. 12), and designs by SMEs allows for more appropriate template design for these specific learning environments.

Anecdotally, Eli Review created space and community

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for students. In Eli Review, the instructor cannot comment on the student writing in the program; they can only add comments on the peer feedback in the revision plan after it is developed. This positions students as agentic forces in their own peer-review processes. Students are required to act independently, to solve their own composition problems, and to assist their peers in problem-solving endeavors. Thus, the structure of Eli Review effectively decentralizes the role of the teacher and positions students as the main actors. This decentralization shows students that the peer review process is a valuable skill that they can learn to use independently.

Furthermore, any opportunity for students to work with each other leads to a sense of belonging and community, which is especially important in online and distance learning applications, but also for in-person classrooms. The use of tools that engage students with each other helps to build a learning community (Berry, 2017). The process of peer review requires knowledge sharing, which develops a community in the online classroom (Waycott et al., 2013). Using Eli Review allowed another layer of student interaction, which, either online or in-person, helped facilitate the development of a classroom community.

Through our first pilot with Eli Review and continued use in our classrooms, Eli Review has been not only interested in hearing our feedback but also has followed through with updates to the program to meet the needs/wants that were determined through the use of the program in our classes. Eli Review has been very responsive to our feedback, and several changes have been made to the platform through continued use by several instructors.

I Don't Give a Damn: Instigating a Pedagogically Sound Technology Revolution

We were interested in trying Eli Review because, simply put, peer review is hard. It's hard to teach; it's hard for students to do well, and it's especially hard when the peer review tools are not built for the teachers and learners who use them. Despite this, peer review is an essential practice that encompasses a very important skill set for students in higher education.

We argue Eli Review improved our understanding and design of peer review activities in our teaching. We also believe our students had more productive and positive peer-reviewing experiences with Eli Review than they did with other tools. We, especially as teachers of writing, acknowledge, however, that Eli Review is not a technology that students are likely to use once they leave the academy. As with us, they are likely to continue using browsers and word processors and social media that have the core design rooted in other cultural needs and practices. However, the goal of Eli Review is not to be used outside of specific pedagogical spaces; instead, it is a teaching tool intended to help instructors facilitate the learning of giving and receiving reviews. Context is everything, and Eli Review's greatest strength is that it is intentionally situated within the context of its users in higher education.

We also argue that tools with SMEs on the design team that are targeted to users in higher education settings, support the development of agency of both teachers and students. In this sense, the agency is a positive correlation. As teachers gain more, students do as well. For teachers, tools designed for specific pedagogical contexts offer the freedom to explore their pedagogy while being supported, rather than constrained, by technology. For students, these tools offer a more centralized role in the classroom and scaffolded development of critical thinking skills which are required for composing and revision texts.

For our purposes, Eli Review clearly articulates and facilitates the processes in which instructors teach and students learn peer review. Whether the instructor is teaching a writing course or assigning writing in a content course, working with an application designed to pedagogically support the teaching of peer review is the batting cage we did not know we needed; the practice and scaffolding that made us better teachers of a better peer review experience. We need more programs to facilitate specific pedagogical moves. Furthermore, our experience with Eli Review supports the notion that technology is indeed not neutral. It matters who develops it, who uses it, and in what context it is used. When a well-developed tool is adopted by its intended user, it can provide an empowering experience to all users.

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