Incorporating Research and Educator Voice in Edtech Design

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Abstract: There is new promise in the use of research-based edtech to support learners; however, it is unclear if learning sciences research is being incorporated in product design to address learners across individual cognitive, social-emotional, and background differences– essential for true learner success. To address this gap, our team partnered with a literacy edtech product to strengthen the implementation of these research-based design features to support the variability of leaners. To evaluate the impact of these supports for learning, we surveyed over 11,000 educators who used the product in their classrooms. Using quantitative and qualitative feedback, we found that teachers were enthusiastic about the features, reporting that they supported a variety of learners. However, many teachers were unaware that these features were available. Importantly, we shared these results with the literacy platform, to further inform its development. Survey findings support incorporating both research and user-voice into design.

Introduction

With a burgeoning field of learning sciences research and a boom in readily available technology in schools (EIA, 2012), there is new promise in the use of research-based technology to support learners. However, academic research often fails to be accessible to, or readily usable by those designing experiences for learners (e.g., educators, edtech developers). Further, research is often siloed within its field, and those within those fields often fail to communicate to a broad audience the complexity and variability of learners from a whole child perspective – across individual cognitive, academic, social-emotional, and background differences – factors which must be addressed when designing for diverse learners.

To support the translation of this research into practice, our research team launched a partnership with a nonprofit literacy organization focused on improving reading comprehension, especially among young readers with diverse needs. As a result of our assessment and recommendations for their student-facing digital platform, the product added a number of research-based features to scaffold students' learning, including, among others, audio versions of articles, split screen of articles and questions, text magnification, guided reading strip, paragraph numbering, and article annotation. This type of partnership is unique in that few edtech products engage with research when building out their platforms (Tripathy et al., 2018), and so these design changes have true potential for impact on student success for the over 15 million students who use the product.

While there is currently limited research on the use of these features in the context of a digital platform, the strategies they are based on have been studied in empirical and practitioner-based literature and suggest potential benefits for learners. Teachers assign their students articles to read on the product's digital platform; thus, the features were added to a student-facing interface where students read articles at different Lexile levels and answer comprehension questions. One goal of this study is to gather evidence of how they support pedagogy in a digital context. The current work surveys educators across the country, and uses qualitative data to better understand digital feature use and impact at the level of different student populations. Below, we outline some of the existing research behind these features, with details on any digital implementation and different study populations when available.

Audio. Research has shown that audio supports can benefit student engagement and learning for students with different needs. For example, use of audiobooks can lead to higher interest in reading among English language learners, and a greater likelihood that students will practice reading on their own (Koskinen et al., 2000). In addition, for students with reading disabilities, audio support during sustained silent reading is related to increased reading fluency (Esteves & Witten, 2011). Text-to-speech audio supports have also been shown to be particularly helpful for students who have poorer reading comprehension (Disseldorp & Chambers, 2002). These findings suggest that audio can support a variety of learners in many of the key areas of reading success including vocabulary development, engagement, and reading fluency.

Split Screen. To support students' working memory and attention, we proposed the addition of a split screen option, which displays both the passage and comprehension questions simultaneously. Use of this feature reduces students' need to recall information from the passage when responding to questions, thereby presumably reducing their cognitive load (Al Nadabi, 2015). Research suggests that a split screen format allows students to focus only on the relevant information and to more efficiently navigate and process the reading material (Jarodzka,

Janssen, & Kirschner, 2015).

Visual aids. Visual reading aids provide students with choice in their experience viewing and interacting with the reading material and can support attention, focus, engagement, and comprehension. The text magnification feature, for instance, allows students to adjust the size of the passage text, which can help in different ways. For example, while larger text has been shown to increase reading fluency for younger children and some children with dyslexia (O'Brien, Mansfield, & Leagge, 2005), other research has found that older or more skilled readers show improved comprehension when reading smaller text, presumably because it increases attention and focus on the text (Katzir, Hershko, & Halamish, 2013).

Other visual aid features that were added include a guided reading strip, which grays out all but a single line of text and may help students who have challenges keeping track of where they are in the text. Paragraph numbering may also help students navigate longer passages, find and communicate evidence from the passages, and facilitate communication with teachers and classmates. Though these benefits have been seen in the classroom, more research is needed on who these features may best support as well as their implementation on a digital platform.

Annotation. Online annotation tools, including highlighting and note taking, similarly allow students to keep track of important parts of the text, and to take notes on their reading. Highlighting text can be a useful visual aid to quickly find key information. To date there is little research on the impact of digital annotation, though there is some promise in the findings thus far. Researchers Lu and Deng (2013) found that online annotations, including highlighting and note taking, fostered active learning by allowing students to locate and integrate evidence, and provide explanations. In addition, actively highlighting text on paper has been shown to benefit comprehension when answering questions related to the highlighted text, for making inferences about the passage, and for comprehension of more difficult passages (Dunlosky et al., 2013).

With the exception of the audio support, which is assigned by the teacher, these features are always available for all students to use, and represent a suite of tools that can be used to support reading for students with varying strengths and challenges. Examining teachers' reactions to these features is critical in establishing when and how features are being used, and how they may promote learning for each student. Our research questions addressed whether teachers were aware of these feature enhancements on the edtech product, whether their students had tried them, and if they had perceived the features to be effective for learning in the classroom.

Methods

Participants

In October 2018, an online survey was emailed to approximately 500,000 active subscribers of the product, probing their awareness and use of 15 features supported by the partnership, including those described above. Of the 11,408 responses we received in one week, 75% were K-12 classroom teachers and 21% were school-based specialists (e.g., reading coaches, special education teachers, librarians), from over 7000 unique zip codes or locations outside of the United States. For this report we were interested in the product use in a school setting and therefore limited our analysis to these school-based educators. We will use the term "teachers" to refer to this group within the context of the survey.

Measures

For each feature, respondents were asked a series of yes/no questions: (1) whether they knew about or had noticed it on the product's website; (2) whether they thought it could support students' learning; (3) whether they had used it or encouraged their students to use it; and (4) whether they had observed it support students' learning. We also asked two overarching questions about the suite of features, asking how likely teachers were to (1) assign more articles; and (2) assign higher-level articles because these features were available to students.

In addition, we asked teachers to respond to two optional open-ended questions. The first asked teachers to provide examples of how any of the features have supported their students' learning, including relevant student characteristics. The second asked them to let us know if there were any features they would like more information about. These responses were coded for (1) the features listed (e.g., "audio supports"), (2) the student population mentioned (e.g., "ELL, above grade level"), and (3) the type of support that the teacher indicated the feature provides, or had questions about (e.g., attention, motivation). Codes were applied to responses until saturation was reached (i.e., the point at which analyzing additional responses did not reveal new information). In total, content codes were applied to 1,716 responses from Grades K-6 teachers and specialists. Intra-rater reliability for the coding was high (pooled kappa = 0.88).

Results

Feature use

For the six features described above, we observed several trends as shown in Figure 1 (see Table 1 for break down by feature). In general, we saw that more teachers reported thinking that a feature could support students' learning than actually knew it existed on the platform. These differences were statistically significant when tested with a 2-proportion z-test ($\chi^2(1) = .414.76$, $p < .001$). Across features, many more teachers reported knowing a feature existed than said they had tried it or encouraged a student to try it ($\chi^2(1) = 2840$, $p < .001$). Finally, when teachers had tried a feature, the majority of them reported that they observed it supported students' learning. Together these results suggest that more outreach is needed with teachers to make them aware of the features and encourage them to try features in their classrooms.

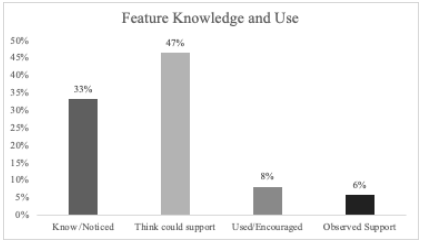

Figure 1. Teachers' responses to survey questions averaged across targeted features.

Table 1: Teachers' knowledge and use of the top six recommended features

Feature	Know/Noticed	Think Could Support	Used/Encouraged	Observed Support
Audio	46%	45	16	12
Split Screen	32	46	7	5
Text magnification	33	46	5	3
Guided reading strip	26	47	5	3
Article Annotation	29	47	8	6
Paragraph Numbering	30	48	8	6

Additional evidence of teachers' enthusiasm for the features came from the two overarching questions about the suite of features. Of the educators who had tried at least one of the features, 89% responded that they were likely to assign *more articles* on the platform and 82% said that they were likely to assign *higher-level articles* as a result of the features available to aid students. These results suggest that the features may encourage teachers to challenge students and maintain high expectations for their performance.

The responses to the open-ended question about wanting more information tended to reflect the quantitative data, suggesting that while most teachers reported a positive impact on students' learning when they knew about and used features, many needed more support in navigating and using these supports. One teacher noted that using the product has helped her below grade level students "*... develop comprehension strategies and vocabulary skills. Knowing that there are these additional resources makes me excited and I will work to integrate these into my instruction as well!"* while another teacher stated that they *"would like more tutorials on the different features…if you could model how some of these features are used. Sometimes teachers do not have time to truly dive into this great website and use to its fullest potential."*

Supports for school success

Responses to the open-ended question about examples of student support pointed to some interesting perceived benefits of the features for students' success in school. For example, 56 teachers (3% of coded responses) reported that these features supported student independence, a critical component of learning. One teacher reported "*Audio is a feature that is essential for all students to be able to work independently and successfully on this site, especially students with learning disabilities,*" while another noted that "*These features can assist students in becoming more independent and responsible for their learning.*"

In addition, we saw a pattern of responses suggesting that the platform and added features support test-taking skills, with 92 (5%) responses receiving this code. For example, one teacher reported that the split screen feature allows for *"…students to refer back to the questions as they are reading the information. This is a great test-taking skill that will transfer from this practice site to online tests."*

Supporting learner variability

We were particularly interested in the frequency that specific features were reported as helpful for particular student populations, and how. The most frequently coded feature from the first open-ended question was the audio supports (699 teachers, over 40% of coded responses). Teachers reported that this feature supported students with

their reading comprehension and argument and discussion skills, and that it primarily aided populations of below-grade readers, English language learners, and special education students. One teacher explained, *"The audio is invaluable for students with reading disabilities. It allows them to participate as their peers do."* while another reported that *"Audio helps ELL students and SPED students, and lower level readers engage with the text instead of struggling to decode the text."* The split screen and annotation features were also frequently mentioned as supporting students' argument and discussion skills. For example, one teacher noted: "*The split screen has helped all my students learn to give evidence from the text to back up a claim.*"

Conclusion

Our study, using both quantitative and qualitative survey data from thousands of educators across the country, provides insights into the use and effectiveness of the digital implementation of several research-based pedagogical features that support different learner needs and that currently have limited existing research. The responses from our survey lend evidence to our hypothesis that providing learner supports can scaffold learner behavior and performance across a range of learner populations and challenges. Teachers report that these evidence-based features supported students through increased access and engagement across the whole child, including cognitive, social emotional, and student background. That is, they describe how features support students with attention challenges (cognitive), a sense of belonging (social emotional), and background differences such as vision impairment, or whose first language is not English (biographical background).

Although almost half of teachers thought that the listed features *could* be used to support student learning, many fewer actually knew about or had noticed the features on the platform's website, meaning they were unable to take advantage of the supports. This finding suggests a need for edtech products to ensure their features are readily available, and provide resources for teachers on how to best implement them. Through the voices of teachers, this study captured the perceived impact that research-based digital features are having in the classroom on a daily basis, including supporting foundational skills such as student autonomy. Importantly, as part of the design process, we have shared these results with school district leaders, so that they have valuable information to help use the platform to its fullest, and with the literacy platform, so they can iteratively design to increase reach and value. Findings from this survey can thereby support incorporating both research and user-voice into future iterations of product design. While further research is needed to determine how features such as these affect learning and performance outcomes longitudinally, our findings are a first step in collaborative research-based design, and shed a promising light on the future of learning.

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