MINDING THE GAP:

The Role of Familiarity in Predicting the Ability of Technology to Improve Learning Outcomes

Like the adage you can lead a horse to water but you cannot make it drink, you can bring technology into the classroom but it won't necessarily improve learning outcomes. As educational technology grows more commonplace, with nearly one in five American students assigned their own device for the school year, and with investment in classroom technology and digital literacy likely to continue, focus must begin to move beyond the question of access to exactly how to select devices that improve children's education. Access alone does not guarantee success. Now that education technology is present in a plurality of classrooms, we must understand how those with access succeed.

Thankfully, researchers have been examining what, if any, elements of educational technology consistently and positively impact learning outcomes. An emerging theme among successful classrooms is teachers' ability to find, deploy and integrate new software and applications. The theory is that specialized software and applications, when adopted properly and integrated into a diverse curriculum, can lead to better learning outcomes. That theory comes with a major caveat, however: these specialized applications must be wholly embraced by the educators. It is not enough to have these apps; educators must understand them so their students can learn from them.

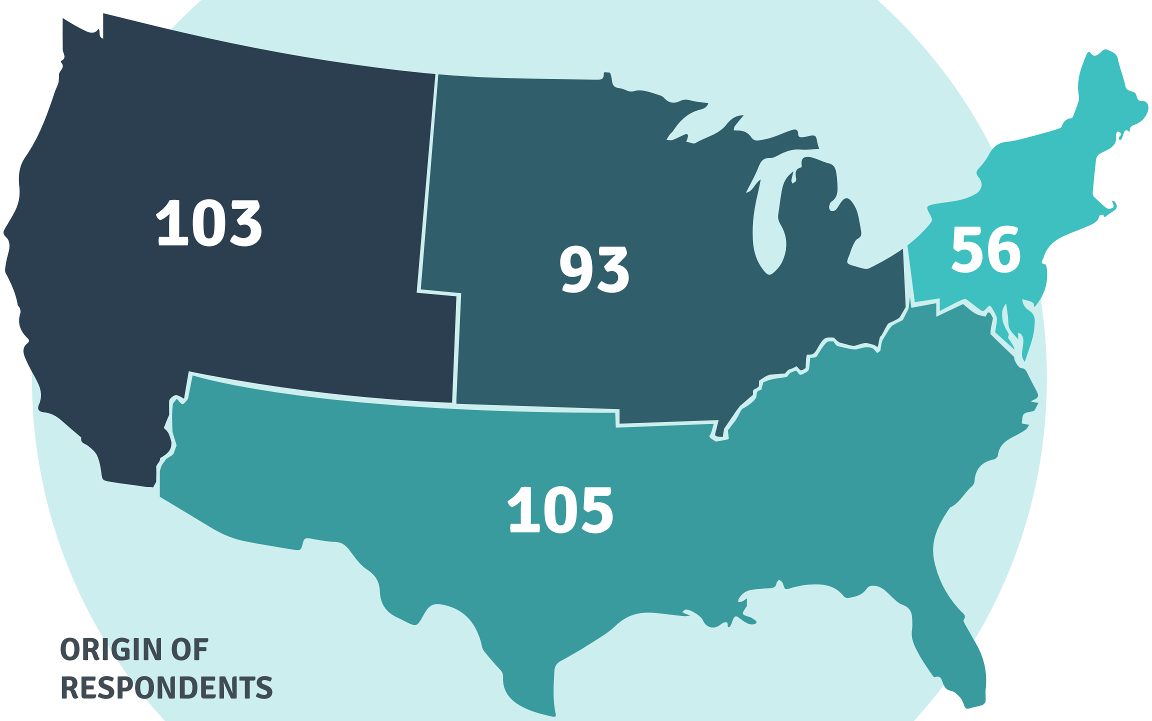
It is educators, therefore, that represent the key stakeholders for the future of education technologies. To ensure that technology is more than just present in the classroom, educators must do more than "buy in" to the concept of educational technology—they must adapt. They must be willing to change the curriculum to advance and innovate along with the technology. Although technology is increasingly becoming commonplace in schools, too much of the conversation about the future (and effectiveness) of education technology focuses on the potential of the device itself.

Whether a device, an app, or a piece of software can achieve marvelous things at reduced prices is irrelevant unless it receives true support from the educators. Just as the best teachers determine and then draw out their students' potential, so too can they determine and draw out their technology's potential. If that's going to happen, decision makers need to ask: How can we support educators to adopt and embrace technology effectively? What holds them back from fully supporting technology in the classroom?

UNDERSTANDING EDUCATOR CHALLENGES

> "By the time I learn it and get comfortable, the skill is obsolete. I feel like I never reach a point of stability with technology. It's like with your phone...every time they update it, I have to start all over."
>
> *Anonymous Teacher*

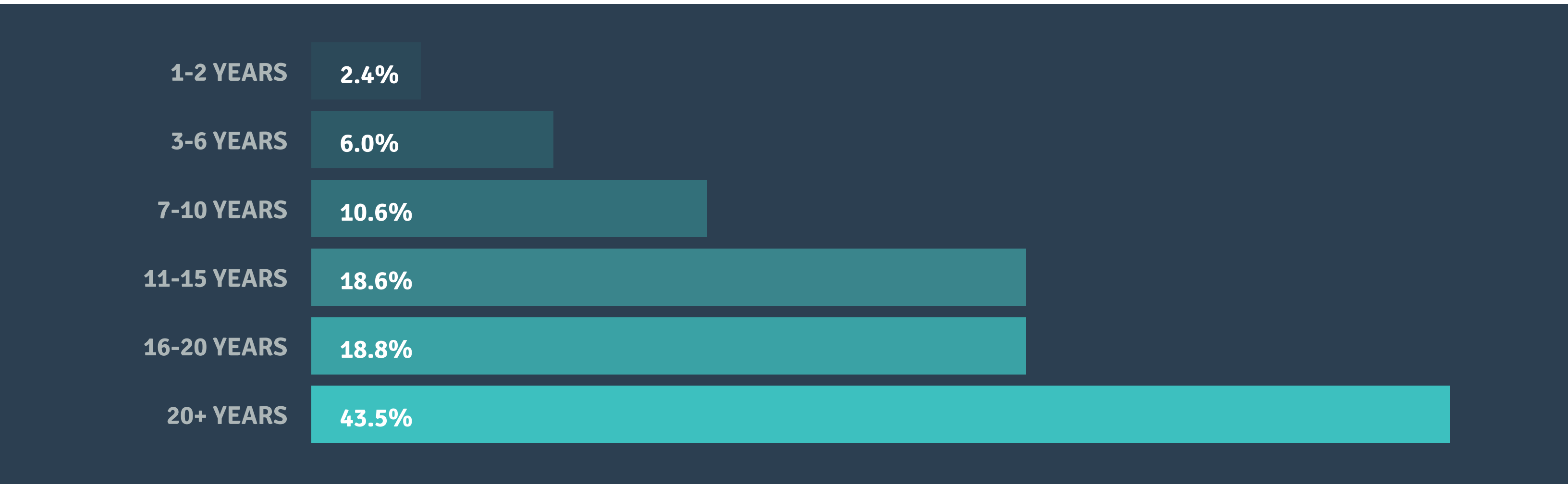
We surveyed 357 teachers from across the country to find out about their perspectives on technology in the classroom.[1] The respondents represented a national pool representing all four major regions with 29.4% from the South, 28.9% from the West, 26.1% from the Midwest, and 15.7% from the Northeast.



ORIGIN OF RESPONDENTS

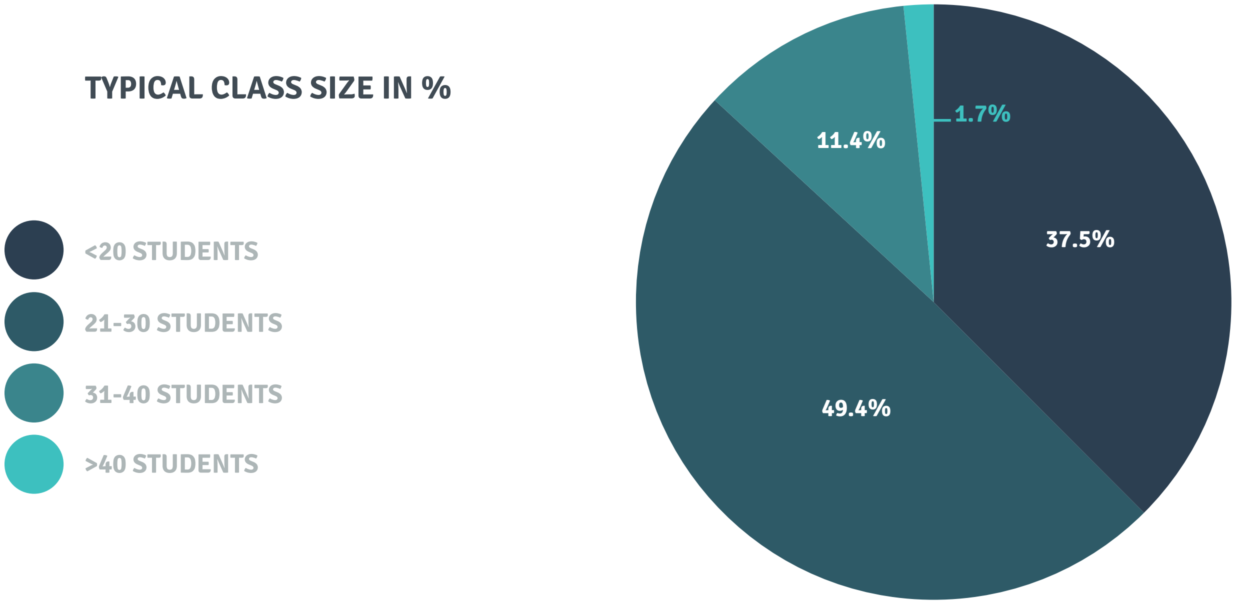
The career lengths also spanned the spectrum, but had a heavy concentration on respondents with careers of over 20 years in the profession which is typical of the overall distribution of career teaching professionals.

CAREER LENGTH OF RESPONDENTS IN %

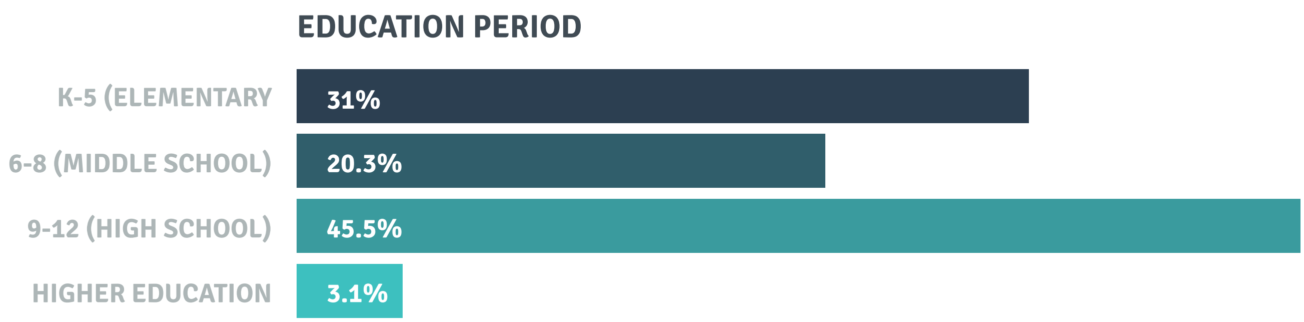


Class sizes varied with 49.4% of respondents had class sizes of 21-30 students. Less than 2% of respondents had class sizes over 40 students.

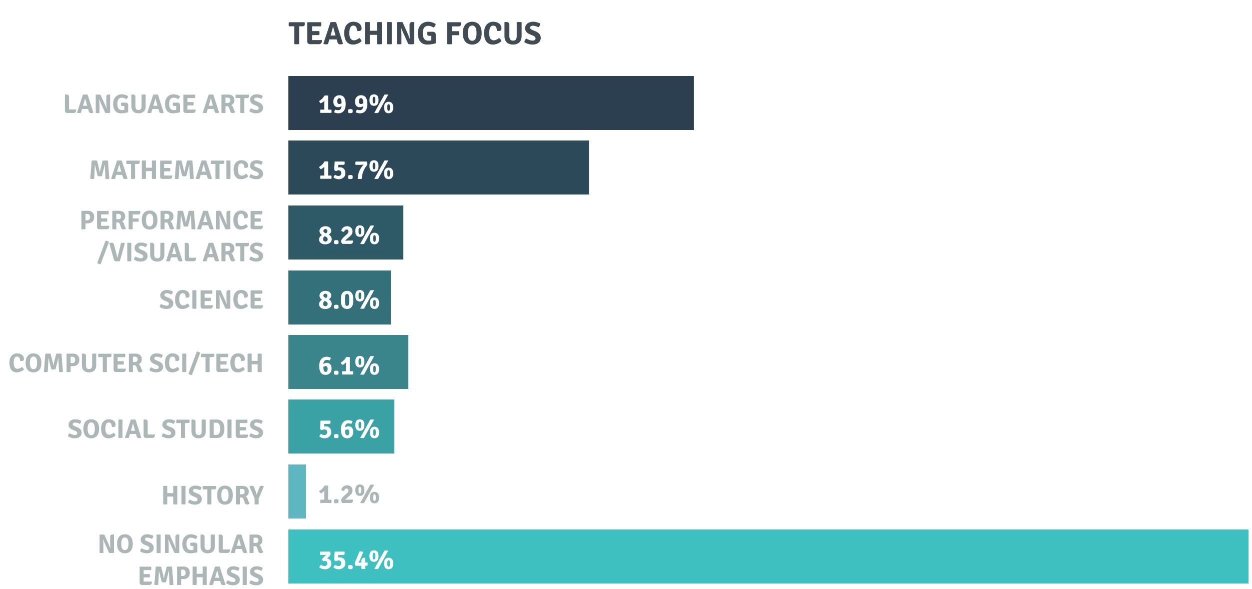
TYPICAL CLASS SIZE IN %



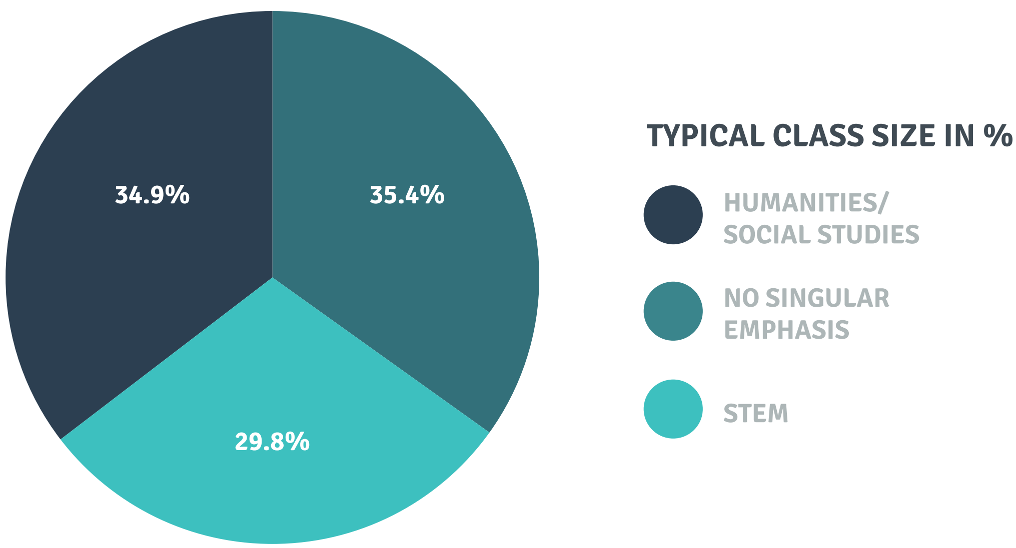
The respondents taught a variety of educational periods with the highest concentration in high school educators (45.5%) followed by elementary school (31%) and then middle school teachers (20.3%). 3.1% of respondents were involved in higher education.



The largest concentration of respondents did not emphasize one area of focus for their teaching (35.4%). Of the teachers that did indicate a focus for their teaching, language arts was the most represented (19.9%) with mathematics (15.7%) as the second largest concentration.



That data was consistent with how the teachers described their overall program placement. The largest share of respondents (35.4%) did not emphasize one specific subject relative to all others. Respondents from the humanities/social sciences represented the largest share of respondents of those who did identify a subject emphasis followed by STEM (29.8%).

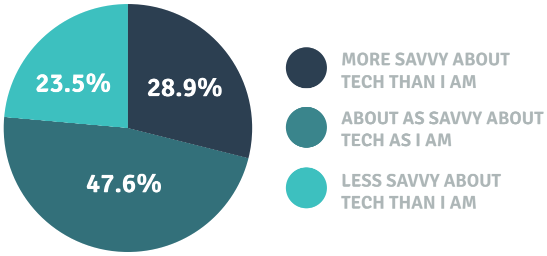


The preferred operating system of the respondents was Windows at 70.6%, with Chrome OS at 15% and OS X at 14.5%.

PREFERRED OS

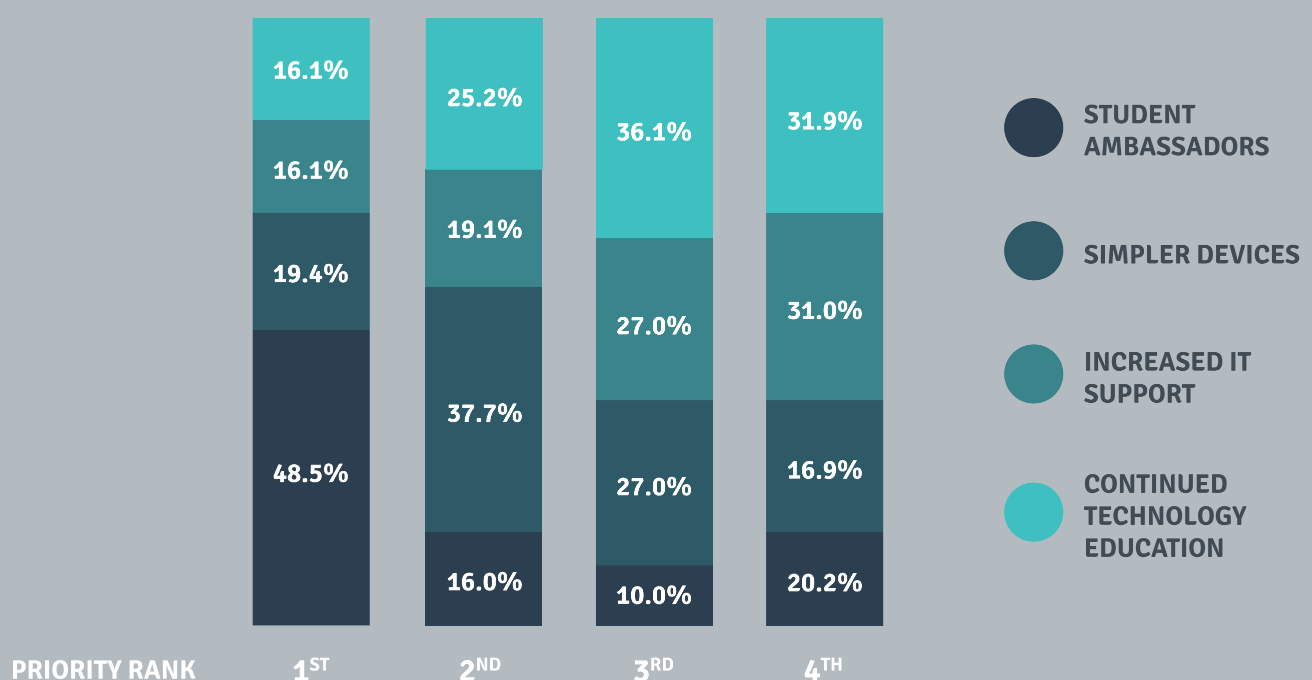
The largest share of respondents (47.6%) assessed that they were equally savvy about technology as their students' with 28.9% of respondents reporting that the students were more savvy than they are and 23.5% of respondents reporting that the students were less savvy than they are.

TEACHERS' PERCEPTION OF STUDENTS' TECHNOLOGY SKILLS IN RELATION TO THEIR OWN



The study confirmed the same results of the six-year meta study that the number one concern for educators is training.[2] When it comes to setting priorities regarding technological teaching aspects, most educators ranked continued tech education highest (i.e., 53.3% ranked it as their top priority; an additional 16.1% ranked it as their top-2 priority); increased IT support was frequently listed as a top-2 priority (37.7%); the deployment of simpler devices and student ambassadors (i.e., empowering students to request tech help from them) were often ranked third and fourth, respectively.

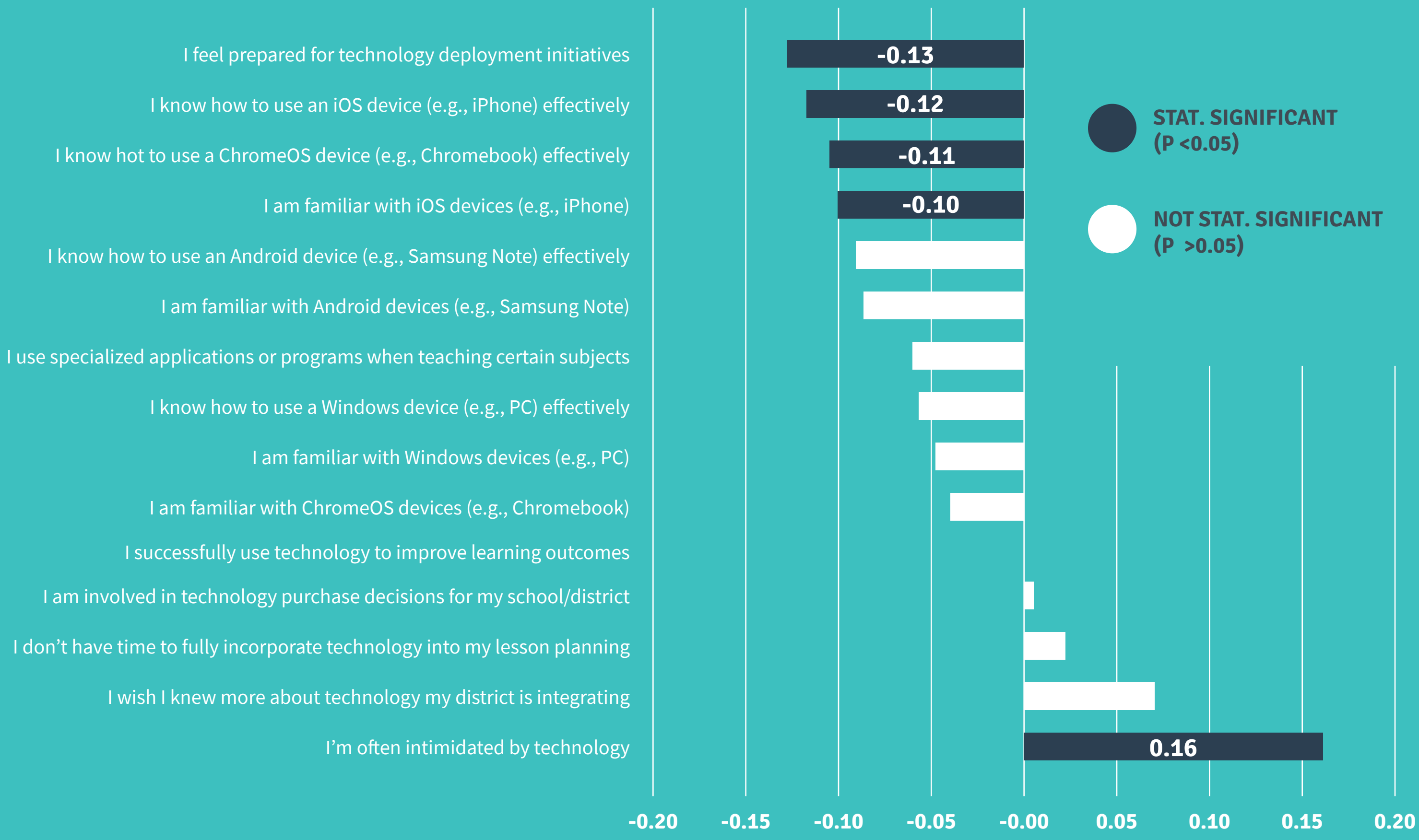
TECHNOLOGY-RELATED PRIORITIES OF EDUCATORS



We found that teachers with longer careers feel significantly less prepared for new technology deployment initiatives (ρ = -0.13, $p < 0.05$), are less likely to know how to use an iOS device (ρ = -0.12, $p < 0.05$) or a Chrome OS (ρ = -0.11, $p < 0.05$) device effectively, and tend to be less familiar with iOS devices in general (ρ = -0.10, $p < 0.05$). However, all those relationships tend to be rather weakly related with career length. Likewise, teachers with longer careers also tend to feel generally more intimidated by technology (ρ = 0.16, $p < 0.05$). This relationship, however, can also be considered only weak. Based on a regression analysis, this influence remains stable (ß = 0.160 (SE = 0.043), $p < 0.001$), even after controlling for class size and teaching level (both of which turned out to be not statistically significant predictors for feeling intimated by technology).[3]

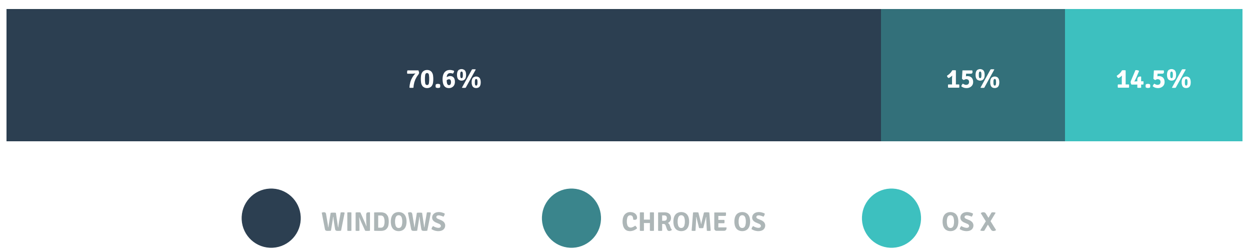
ASSOCIATION BETWEEN TEACHER'S CAREER LENGTH AND SELF-EFFICACY PERCEPTIONS REGARDING THE USE OF TECHNOLOGY IN THE CLASSROOM

(SPEARMAN'S RANK CORRELATION COEFFICIENT)

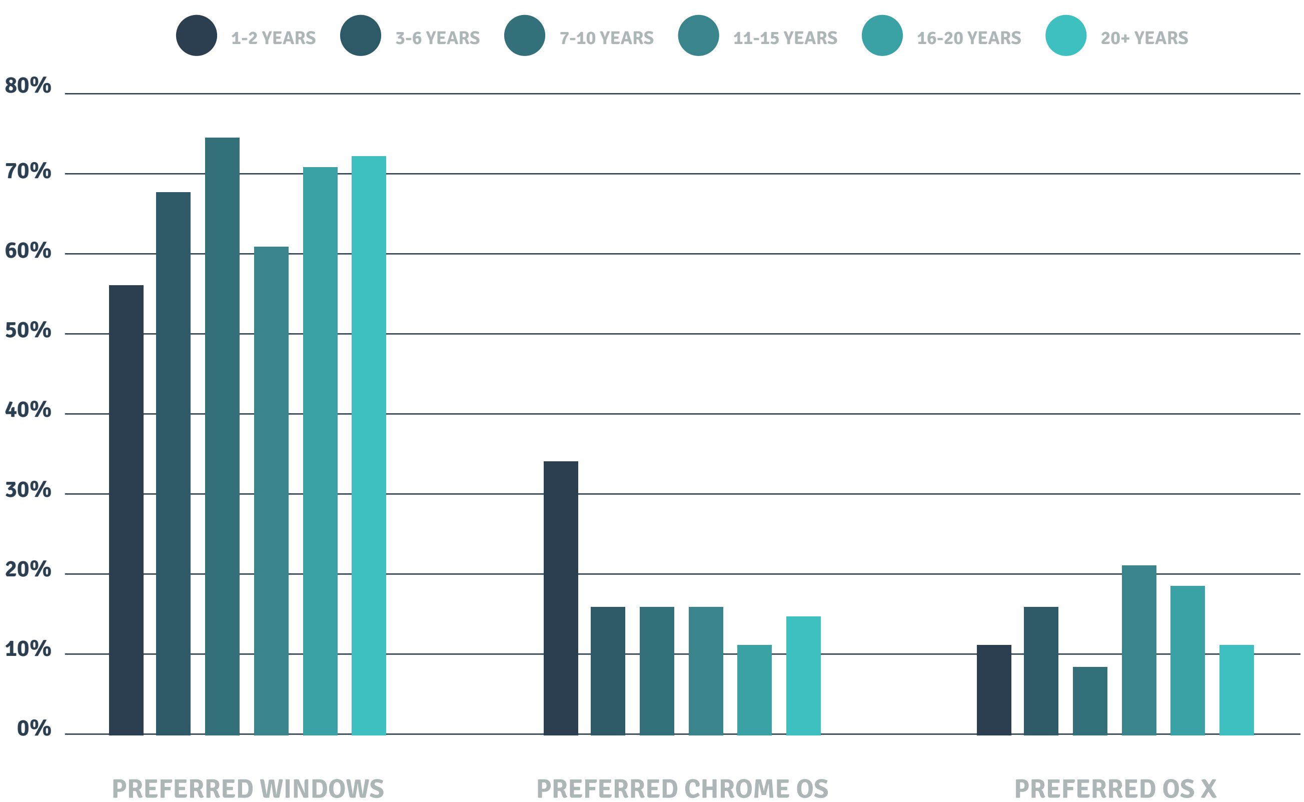


Given the concerns about training time and IT resources, we wanted to understand how existing or previous familiarity with particular devices impacted the perception that they had insufficient time. The first thing we asked was their most familiar operating system (70.3% were most familiar with Windows with Chrome and OSX basically tied).

PREFERRED OS



PREFERRED OPERATING SYSTEMS BY TEACHER'S CAREER LENGTH



We were also curious if career length played a role, not just in device familiarity, but in their other desires to be involved in technology decision making (the answer was no). In fact, regardless of their career lengths, teachers do not seem to be particularly concerned about getting involved in the technology decision making process.

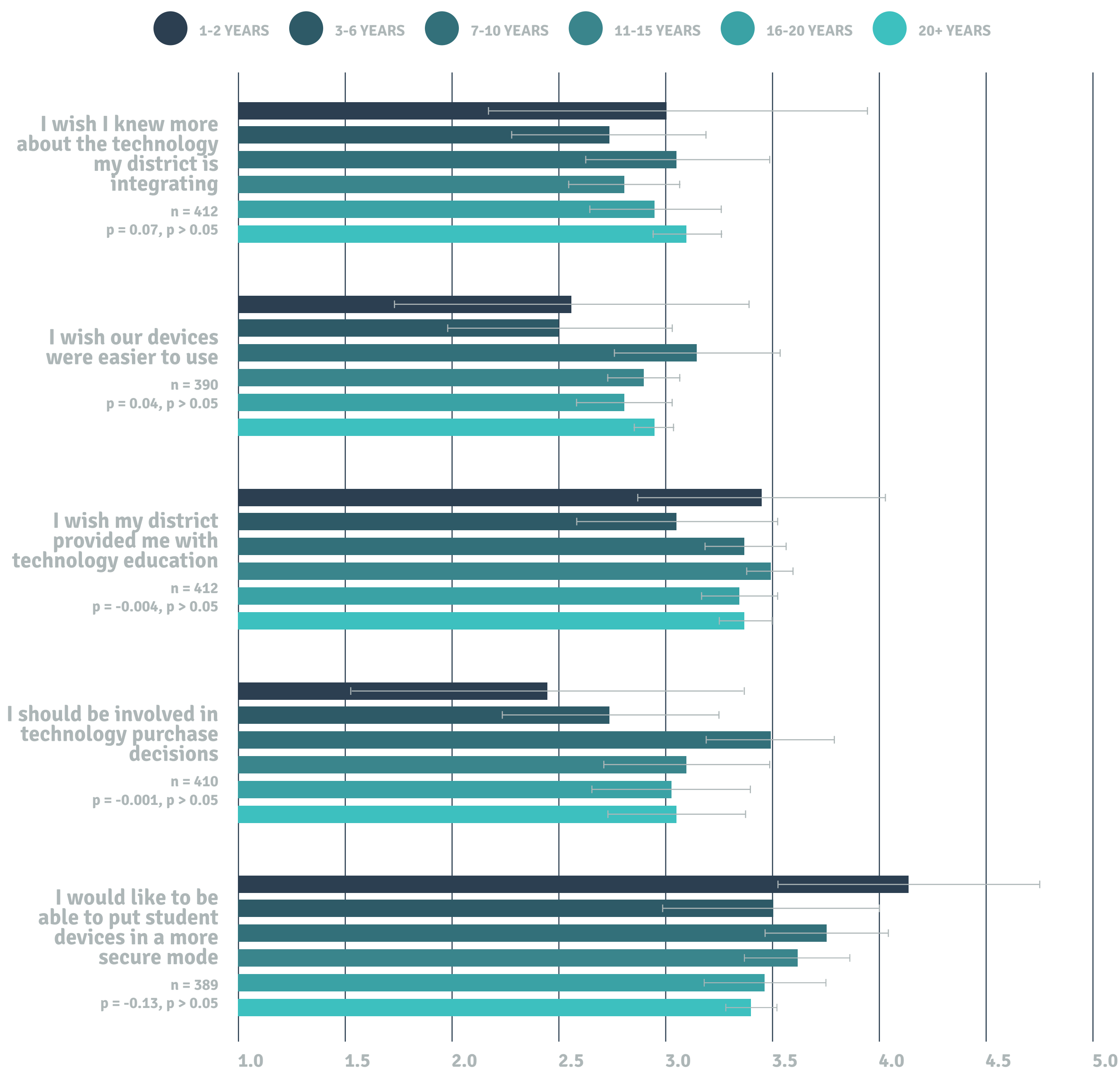
There was however, a weak correlation between the length of a teacher's career and their concerns about the security of the student devices. The only item that shows a statistically significant negative correlation with teacher's career length is related to security aspects of student devices ($\rho = -0.13$, $p < 0.05$); this suggests that teachers with longer careers are slightly more concerned about the security modes of their students devices and wish to have more autonomy in the classroom to put them in a more secure mode. However, the correlation is only weak. On average, the highest agreement among respondents exists with regard to teachers' desires to be involved in security decisions about their students' devices ($M = 3.49$, $SD = 1.14$) and the desire to receive more technology education from the district ($M = 3.35$, $SD = 1.13$). The latter point emphasizes the finding that continued technology education is considered a top priority among respondents.

Interest in putting student devices into a more secure mode had the highest agreement among respondents with a mean of 3.49, which was, in fact, higher than the mean of 'I want more technology education from the district' (3.35). In other words, independently of additional education, teachers wanted to be empowered to put student devices on a more secure footing.

Interestingly, regardless of their familiarly with operating systems outside the classroom, all respondents were equally likely to say they didn't have the time to fully incorporate technology into their lesson plan. One teacher noted, for instance, that one of the biggest obstacles to adoption was, "Having enough professional development to keep up with technology and then the time to create lessons and implement them well." Regardless of their familiarity with operating systems outside the classroom, all users were equally likely to say they don't have time to fully incorporate technology into their lesson planning, $F(2, 402) = 2.375$, $p = 0.09$

TEACHERS' CAREER LENGTH AND DESIRE TO BE PART OF THE TECHNOLOGY DECISION MAKING PROCESSES

(GROUP MEANS BY CAREER CLUSTER)



TIME, TIME, AND MORE TIME:

Making 1:1 Work for Educators

> "[My greatest concern is] not having enough time to learn the technology to implement it in the classroom."
>
> *Anonymous Teacher*

The open-ended responses and the quantitative data show that there is no more important concern for educators than having the right amount of time for appropriately planning and executing a full adoption of technology in the classroom. The data supports that the concerns about time revolve around training on new technology and time for planning to incorporate the technology into the curriculum in ways that actually improve learning outcomes.

One of the clearest takeaways from the survey is that teachers are concerned that they are being set up to fail. The mandate from administrators and society at large is to utilize technology to improve learning outcomes, but there simply is not enough time allocated to do that effectively. One teacher put in succinct terms:

> "Educators attempt to implement technology because they are directed to and have hope that it will improve learning outcomes and simplify teaching. Unfortunately, this usually falls short due to lack of training or time thus resulting in inefficient superficial or downright ineffectiveness."

Given that concern about time was articulated over and over again as an essential variable in the success or failure of technology adoption, we ran a series of ANOVAs and a regression analysis to identify statistically significant predictor variables (with the concern about time entered as the outcome variable): Being concerned about not having enough time for tech training is:

Unrelated to geographical region, $F(3, 349) = 1.390$, $p = 0.25$. I.e., overall there are no statistically significant differences among educators who work in different regions across the U.S.

Unrelated to an educator's career length, $F(5, 404) = .669$, $p = 0.65$. I.e., overall there are no statistically significant differences among educator groups defined by career length.

Unrelated to an educator's teaching subject, $F(2, 406) = .665$, $p = 0.52$. I.e., overall there are no statistically significant differences among educator groups defined by teaching subject. Educators in STEM, "non-STEM" (e.g., humanities, social sciences, arts, languages) and those without a primary subject area have the same concerns regarding time.[4]

Mostly unrelated to class size, $F(3, 405) = 1.924$, $p = 0.13$. I.e., overall there are no statistically significant differences among educator groups defined by class size.[5]

Unrelated to preferred choice of operating system outside the classroom, $F(2, 402) = 2.375$, $p = 0.09$. I.e., overall there are no statistically significant differences among educator groups based on their preferred choice of operating system outside the classroom.[6]

Statistically significantly and positively related to education level, F (3, 405) = 2.859, $p < 0.05$. I.e., the higher the level of education the more educators are concerned about not having enough time for tech-related training. Educators in higher education are most concerned (M = 3.08, SD = 1.19) and educators in K-5 are least concerned (M = 2.51, SD = 1.20), with educators in middle (M = 2.59, SD = 1.27) and high school (M = 3.86, SD = 1.16) falling in between.

Highly statistically significantly related to self-perceptions of one's tech know-how vis-à-vis tech savviness of students, F (2, 406) = 7.109, $p < 0.001$. I.e., Those educators who believe their students are savvier about technology than themselves are significantly more concerned about not having time for tech training (M = 3.05, SD = 1.15) than those educators who think their students are about as (M = 2.58, SD = 1.16) or less savvy (M = 2.54, SD = 1.26) about technology as they are. A post-hoc comparison test confirmed the statistical significance between the first and the second / third group. This seems plausible as educators who feel their students have more tech skills than their educators feel a stronger need to catch up but are often constrained by time.

Adding the last two predictors – first education level, then comparison with students' tech savviness – into a linear (OLS) regression model to predict concern about time largely confirms the above findings. However, education level becomes a less significant predictor ($p = 0.06$ – i.e., slightly failing the conventional 0.05 level of statistical significance) after controlling for self-comparisons with students' tech savviness, which represents the strongest predictor for concern about time.

The data reveals that while educators from across the spectrum are concerned about having enough time to successfully adopt technology in the classroom, there is a specific subset of educators that is the most concerned about having enough time: educators who teach high school and perceive that their students are savvier with technology than they are. For those educators, there is strong statistical evidence that time is an essential component of their concern about integrating technology in the classroom. One teacher described this exact scenario in the open-ended section. The teacher writes that the greatest obstacle to a successful adoption of technology in the classroom is:

> "I don't understand it; my students know more than I do and I can't keep up. When something goes wrong, I am clueless about how to fix it."

It makes sense that teachers might be concerned about both maintaining credibility in front of their students and also ensuring that they can control what is happening with the technology in the classroom. There are countless popular culture depictions of students manipulating technology with an "inept" teacher as the victim of their classroom technology hack. The data reveals that the fear that the students know more may be impacting the willingness of the teachers to try to adopt technology in the classroom in meaningful and substantive ways that can improve learning outcomes rather than simply as a supplement to the existing curriculum.

THE FAMILIARITY GAP:

How the Future of Student Learning Outcomes May Rely on Understanding Cognitive Lock In

> "Cognitive costs are dynamic and change with experience. With practice, the time required to accomplish a task decreases. For example, it should be much more efficient to search a favorite site – following, we hypothesize, a power relationship with amount of use – than to learn the layout of a novel site. This would imply that perceived switching costs increase the more times a favorite site is visited, which creates a cognitive 'lock-in' to that site over time, just as firms can lock in customers with high physical switching costs."[7]

The strength of the data related to time invites a deeper examination of the implications for the 1:1 paradigm, or the one device for every child ideal of education technology. If concern for time is a consistent and universal feature, regardless of a large number of other variables, then we wanted to inquire if that variable had any significant relationship to the reality inside the classroom relative to the reality outside of the classroom. In other words, is there reason to think that what educators are doing outside the classroom could affect their perceptions of the need for more time to adopt technology in the classroom? The data led us to consider the role of familiarity with operating systems.

While we cannot necessarily intuit that familiarity with an operating system outside of the classroom corresponds to a preference inside the classroom (this inference is reasonable, but not confirmed by the survey evidence) we did infer that familiarity with an operating system outside the classroom reflected the majority of experiences with a particular device style or operating system in the classroom. As a result we identified two segments of the survey respondents, those who are most familiar with the same devices outside the classroom as the ones they use inside the classroom (in other words, no gap between outside and in) and those who are most familiar with an operating system that is different than the operating system on the devices used inside the classroom. This distinction between non-gap and gap audiences seems significant because a large part of the learning curve for any piece of education technology and any device requires familiarity and frequent use of that technology's operating system. Chrome OS, for example, functions and organizes information very differently than Windows 10 or OSX.

PREFERRED OS

The majority of educators in the subsample indicated that their students primarily use Chrome devices (n=35, 38.0%), followed by Windows (n=28, 30.4%) and Apple (n=25, 27.2%); smaller fractions mentioned none of the above (n=1, 1.1%) or multiple (n=3, 3.3%; excluded from further analysis). Comparing this measure with teacher's familiarity with operating systems and devices outside the classroom (which was asked in the original survey), we created a new measure related to the familiarity gap between students and teachers:

> **Less than half of the respondents in the subsample** (n=39, 43.8%) indicated that they are most familiar with devices and operating systems that their students primarily use in the classroom (i.e., no gap).
>
> **More than half of the respondents** (n=50, 56.2%) indicated they are most familiar with a device or operating system *different* from what their students primarily use in the classroom (i.e., a gap exists).

When examining this data in light of technology anxiety, there was not a statistical significance between being intimidated and wanting to be involved in the technology decision making process. There are no statistically significant differences between those two groups regarding: Their anxiety about technology ("feeling intimidated by technology", $t(87) = -0.96$, $p = 0.34$; desires to be part of the technology decision-making process (Knowing more about technology the district is integrating, $t(87) = 0.37$, $p = 0.71$ and being provided with technology education by the district, $t(87) = 0.82$, $p = 0.42$). Additionally, with regard to teacher demographics, there are also no statistically significant associations between device gap and career length ($\chi2(5) = 2.32$, $p = .80$), typical class size ($\chi2(3) = 1.94$, $p = .58$), and level of education ($\chi2(3) = 4.16$, $p = .25$). Finally, on all other questionnaire items, including priorities (i.e., both groups ranked continued tech education highest, followed by increased IT support, etc.), the two groups scored similarly (i.e., the differences in group means are not statistically significant).

There were however, two items that approached significance:

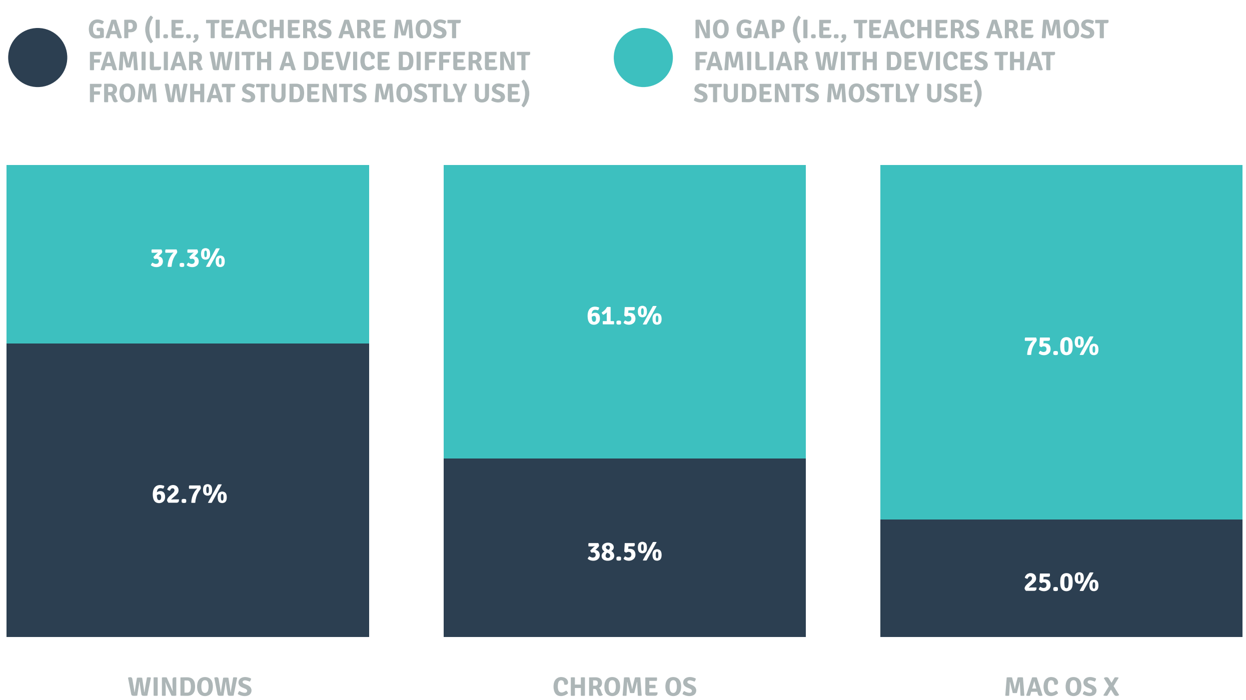
> **Geographical region:** Educators located in the Midwest and West (incl. Mountain and Pacific) (71.4% and 70.8%, respectively) most often experience a device familiarity gap compared to educators in the Northeast (56.5%) and the South (37.0%), $\chi 2(3) = 7.45$, $p = .059$
>
> **Primary teaching subject:** Educators who primarily teach history (100%), performance/visual arts (83.3%), and mathematics (75%) are most likely to experience a device familiarity gap compared to those who primarily focus on teaching computer science (12.5%) and those whose teaching does not emphasize one specific subject relative to all others (46.4%), $\chi 2(7) = 13.82$, $p = .054$.
> Interestingly, but not surprisingly, teachers who experience a gap were less likely to use specialized apps than those who did not experience a gap.

On all other questionnaire items, including priorities (i.e., both groups ranked continued tech education highest, followed by increased IT support, etc.), the two groups scored similarly (i.e., the differences in group means are not stat. significant), *except* for the use of specialized applications or programs when teaching certain subjects. Those teachers who already experience a gap are less likely to use specialized apps ($M = 3.42$, $SD = 1.14$) than those who do not experience such a gap between them and their students ($M = 4.10$, $SD = 0.88$) – this group difference is highly statistically significant, $t(87) = 3.08$, $p < 0.01$.
Most fundamentally, and most importantly, for this project, there is a statistically significant difference between the two groups regarding their concerns about

time. *Teachers who experience a familiarity gap were more likely to say they do not have enough time to incorporate tech into their lesson plan compared to those who do not experience such a gap*. These two groups (i.e., those teachers who experience vs. do not experience a gap in device familiarity between them and their students) are compared regarding their levels of technology-related anxiety and stress as well as concerns and desires to be part of the technology-related decision-making processes. There is a statistically significant difference between the two groups regarding their concerns about time:

Teachers who experience a familiarity gap were *more likely* to say they do not have enough time to fully incorporate technology into their lesson plan (M = 3.02, SD = 1.30) compared to those who do not experience such a gap (M = 2.44, SD = 1.33), $t(85) = -2.07$, $p < 0.05$.
One item that shows a strong statistically significant association is related to teachers' familiarity with operating systems (i.e., their preferred OS outside the

GAP BETWEEN TEACHERS' AND STUDENTS' FAMILIARITY WITH OPERATING SYSTEMS



classroom and teaching duties), $\chi2(2) = 5.95$, $p = .05$), indicating that Windows users experience a device gap much more often (62.7%) than Mac OS X users (38.5%) or Chrome users (25.0%). Hence, Windows users are most affected by the device gap. In other words, educators who are most familiar with Windows/PCs often face students whose primary devices in the classroom are either Chromebooks or iPhones and whose preferred choices of OS are either Chrome or OS X.

The explanation for this phenomenon rests in a concept that neuroscientists refer to as cognitive lock-in. As the opening quote above suggests, cognitive lock-in relates to the familiarity any user has with a given navigation system. The more familiar a user is with a basic navigation system, the easier it is for them to absorb new information from that system. Think about this in your own life. How many times has an interface changed and left you frustrated? Even if the new interface resolves three or four steps that you used to have to follow by making the navigation more efficient, you are angry at the change because the new system is new. Cognitive lock-in is a problem that most of resolve by simply learning the new system because we have to learn it. We may be frustrated by the new system, but we need it so we use it until it becomes a new habit or heuristic and that works (until the next change). The problem for the 1:1 paradigm is that there is a stronger role for the agent, the educators, to simply not use the technology or to devalue the technology to avoid the hassle of learning the new system.

Web developers know first-hand the free choices that users make in deciding to revisit a website or not. Developers struggle between putting up new content within the “ease” of the existing framework and releasing a new navigation that is more efficient. The reason that web developers find themselves working within the existing/less efficient frameworks rather than redesigning an entire website is because the evidence is clear that cognitive lock in has serious ramifications for user activity. According to a study by Johnson, Bellman, and Lohse:

Applying the concepts from cognitive lock in to the future of the 1:1 paradigm, we find a serious challenge for educators experiencing the familiarity gap. The data

> The major implication of the power law of practice is that a navigation design that can be learned rapidly is one of a Web site's strongest assets. Although it is inconceivable that a Web site would be designed to be difficult to use, our results show considerable variation in ease of learning across sites and, perhaps most important, indicate that easier learning of a Web site leads to an increased probability of purchase. This suggests that the layout of a site can be an important strategic tool for online stores. Our advice for managers of Web sites with rapid learning rates is to maintain the current navigation design if possible. Altering the navigation design of a site reduces the cognitive lock-in effect of practiced efficiency and reduces an important competitive strength. If customers must learn a site design all over again, they might decide to learn someone else's instead. Customers come back on repeat visits to find new content, and the more varied the content, the more they will be encouraged to return. Whereas content should be refreshed often, changes in site design should be reviewed carefully.[8]

reveals that educators are less likely to work towards adopting technology in their classrooms in meaningful ways that can improve learning outcomes if they are less familiar with the technology at hand. These same educators are more likely to articulate a need for training time and dedicated time to integrate the technology into their lesson plans. If stakeholders buy the newest and greatest technology to achieve the 1:1 paradigm, but do not have a plan to address cognitive lock-in that results from the familiarity gap, then we will all miss out on the critical moment when technology will be judged based on its ability to improve learning outcomes.

The familiarity gap thus poses a significant challenge for the future of the 1:1 paradigm. Regardless of the importance of mobile devices for consuming media, social networking, picture-taking, and turn-by-turn navigation, the simple reality is that in higher education and in the workforce, people work on more robust computing devices. This is not a trend that is likely to change because different form factors enable different functions. As such, the continued dominance of Windows computers in this device category is something that technology decision makers must grapple with in meaningful ways. The decision to adopt Chrome OS may make sense in the short term and in the confines of the educational environment, but our research suggests that using an operating system that generates anxiety for educators, as a result of the familiarity gap, may be contributing to concerns among those educators about their abilities to properly use this technology to teach their students. Educator concerns, in turn, reduce the likelihood the educators actually use the technology in meaningful ways that can improve learning outcomes. Without evidence that the 1:1 paradigm is contributing to learning outcomes, the paradigm falls apart.

This is not to suggest that Chrome OS has a structural deficiency in comparison to Windows 10 or to OSX. Fans or advocates of any of these operating systems could debate the pros and cons of each OS relative to each other, but those arguments are outside the purview of this research. Instead, the research simply suggests that the device ecosystem outside of the classroom impacts the efficacy of technology inside of it—the more familiar an educator is with a computing OS outside of the classroom, the greater their perception that they could productively and efficiently integrate that device into their pedagogy.

CONCLUSION:

Ignore the Familiarity Gap at students' Peril

For good reason, many of the conversations about the benefits of educational technology have focused on the access gap: who has devices and who does not? At the same time, there are ongoing debates about the qualitative benefit of these technologies. Do they really enhance the student experience? Do they improve the learning outcomes? To what extent should schools be responsible for teaching digital literacy?

The problem is that these two sets of questions—does technology actually improve learning outcomes, and how do we equalize access to the technology—elide a far more nuanced debate about how to integrate technology effectively. In other words, focusing on who has devices, and why students should have them, is only half the story. As our paradigms and our data evolve, we also need to more clearly focus on how these devices get integrated into our existing pedagogical approaches, and how the educators who are the front line of device integration can do so effectively, with minimal disruption to what is already a heavy workload.

In this discussion of how, not all devices will be equal. If we think of a computer as a fancy web portal, we do a disservice to the digital literacy goals of the next generation, particularly those that might not have access to a more robust device at home. If we think of a computer as a rarefied object, only used for very specific instances, we miss out on helping students learn how to truly benefit from integrating technology into their future scholarship and work efforts.

If we're going to move beyond our first generation of educational technology concerns into a world in which students truly benefit, we must follow a path that offers security, simplicity, and ease without sacrificing the value that these devices should provide.

This will require an evolution in how we think about these devices. The closed ecosystem of Chrome OS offers significant advantages to security, but also imposes severe limits on the types of activities that can be done with these devices. As with society, so with schools—we shouldn't have to trade the freedom to learn for the need for more secure devices. Google needs to do more in this regard, and schools need to be willing, if they want to invest in the how of educational technology, rather than merely the what, to prioritize device selection accordingly, including their budgets.

Microsoft, to their credit, seems to have finally come around to understanding this, with their move toward Windows 10 in S mode, which offers a more secure Windows experience that takes advantage of the greater level of overall OS familiarity and superior OS functionality. The Microsoft Store app portfolio will need to expand, and if Microsoft is serious about powering the next evolution of educational technology, we will see them strive to make efforts to build not just copies of the apps in the Chrome or iOS stores, but to instead develop applications that take advantage of what the robust Windows OS can do as a platform, and the computers that come along with it.

What our research suggests is that the choice of device OS is not simply a choice of IT decision-makers' preference. Integrating devices into educational curriculum is a complex process in which each progressive step accumulates new and different student benefits. Those incremental improvements provide learnings that feed the next cycle, the next year's lessons, so that educators improve on their own capacities.

If we oblige educators to overcome a steeper learning curve, and add to that incline the burden of a lack of familiarity, we risk a less robust integration: the proverbial horse standing by the water, but not quite sure of how and why to drink. In such classrooms, learning will happen, but technology integration will be less robust, and less confident.

The Familiarity Gap is not the only element that will need to be addressed, of course, but it is part of the equation. There will be others, and key decision-makers will need to be cognizant of the research and the capabilities (positive and negative) of educators. If they choose not to do this, the schools that reduce the question of integration to the cost of a device may well find that their students, and their staff, end up paying the price.

[1] Describe the survey instrument and descriptive analysis of subjects here.

[2]Archer, Karin & Savage, Robert & Sanghera, Sukhbinder & Wood, Eileen & Gottardo, Alexandra & Chen, Victoria. (2014). Examining the effectiveness of technology use in classrooms: A tertiary meta-analysis. Computers & Education. 78. 140–149. 10.1016/j.compedu.2014.06.001

[3]All other items failed to reach statistical significance (at the conventional 0.05 level), indicating that a teacher's career is unrelated to familiarity with other devices, such as Android or Windows devices.

[4]Less surprisingly, based on the original survey items, the group least concerned about time are educators focused on teaching computer science; those most concerned are educators focused on teaching history (however, the subsample sizes for some groups, such as historians [n=5], are very low so that statistical comparisons are not meaningful).

[5]However, there is only a statistically significant difference ($p < 0.05$) between those who normally teach classes with 31-40 students ($M = 2.94$, $SD = 1.29$) and those who teach classes with more than 40 students ($M = 1.86$, $SD = 1.07$), based on a post-hoc comparison test (Fisher's Least Significant Difference).

[6]One could argue that this approaches stat. significance (by raising the significance level to 0.10). However, there is only a statistically significant difference ($p < 0.05$) between Chrome users ($M = 2.84$, $SD = 1.23$) and OS X users ($M = 2.40$, $SD = 1.03$), based on a post-hoc comparison test (Fisher's Least Significant Difference).

[7]Johnson, Eric & Bellman, Steven & L. Lohse, Gerald. (2003). Cognitive Lock-In and the Power Law of Practice. Journal of Marketing. 67. 10.1509/jmkg.67.2.62.18615.

[8]Johnson, Eric & Bellman, Steven & L. Lohse, Gerald. (2003). Cognitive Lock-In and the Power Law of Practice. Journal of Marketing. 67. 10.1509/jmkg.67.2.62.18615.

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Emphatic Thinking is a consulting agency that improves how companies Go-to-Market. We conduct original research on trends and attitudes that affect various industries and clients, in an effort to understand how to best prepare for and respond to the rapidly changing digital landscape.