The Internet and K-12 Education: Capturing Digital Metrics During the COVID-19 Era

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Abstract

As districts nationwide transitioned online to deliver remote or hybrid instruction as a result of the COVID-19 pandemic, the Internet has become an increasingly important space for K-12 students, teachers, and many other stakeholders. This brief discusses the utility of Internet metrics to measure K-12 district websites and its usefulness for exploring the digital nature of K-12 schools. We close this brief by discussing the necessity to explore K-12 Internet metrics, as the Internet has become an important data source for many diverse stakeholders.

Keywords
K-12 school districts · Internet metrics · Digital metrics · Websites

Even before the COVID-19 pandemic, the Internet had forever changed K-12 school districts (Childs & Taylor, 2022; Jones & Figueiredo-Brown, 2018). Yet, the research into the measurement of K-12 school districts has largely remained unchanged. Traditional scholarship regarding measurement of K-12 school districts has primarily focused on physical metrics (students, teachers, classrooms, and schools) or fiscal metrics (per-pupil spending, salaries) (Jabbar, 2015). However, over the past twenty years, school districts have increased their marketing, informational, and advertising presence online, given the way that the Internet has rendered the K-12 landscape a more competitive one (Taylor & Childs, 2020; Childs & Taylor, 2022; Jabbar, 2015). Amplifying the importance of the Internet, COVID-19 has forced many K-12 school districts to shift operations and instruction onto online platforms and environments, rendering it necessary for teachers and students to rely heavily on the Internet to teach and learn (Borup et al., 2020; Childs & Taylor, 2021, 2022).
The transformation of online education, both in practice and organizationally, presents opportunities for educational researchers to collect and analyze digital data that could be useful for understanding policy and practice decisions in school districts, especially as it relates to the access to and quality of online or hybrid teaching and learning (Childs & Taylor, 2021, 2022). Although reliant on physical wires and conductors, digital technology has advanced to the point where now, the world wide web can be measured through digital means, allowing researchers to explore new digital web metrics that could not be measured decades prior. These digital web metrics can provide insight into how many people visit a website, how much an organization spends on hosting website traffic and web advertisements, and how visible a website is within search results, to name a few. As a result, researchers and policymakers can better understand how a K-12 school or school district invests in their website, thus influencing the accessibility and quality of the website itself (Taylor & Childs, 2020, Childs & Taylor, 2022).

Understanding how K-12 school districts leverage their websites is critical to conceptualize how school districts spend on web technologies and whether certain schools or school districts are better positioned to educate students and maintain a competitive advantage in an increasingly competitive online marketplace (Childs & Taylor, 2021, 2022; Jabbar, 2015). Prior research in higher education revealed that an institution’s digital web metrics can help to explain their influence, popularity, and overall web presence, which in turn influences student enrollment and tuition revenue dollars (Alsmadi & Taylor, 2019; Jones & Figueiredo-Brown, 2018; Taylor & Bicak, 2020). At the K-12 level, little is known about how digital web metrics vary across schools or school district types, yet this type of insight is crucial, especially in a COVID-19 environment where access to the web became absolutely essential for teaching and learning.

In this brief, we call attention to the utility of digital web metrics as a data source and analytic technique that can provide researchers with insight on how school districts invest in and leverage their websites, influencing how K-12 students learn and how K-12 teachers teach. In addition, recent research on K-12 school district competition has explored the competitive marketplace that school districts engage within to help facilitate improvement in student enrollment, advertising and marketing, and teacher recruitment (Childs & Taylor, 2021, 2022; Jabbar, 2015; Jones & Figueiredo-Brown, 2018). As a result, we engage with a digital web metric software program called SEMrush (2020) to analyze the websites of a wide variety of K-12 school district websites in Texas, as Texas’ growing population and unique combination of rural and urban school districts provides ample opportunity to provide generalizable insight. We then highlight the differences in digital web metrics between types of school districts (e.g., charter, urban, rural) and how these differences could impact policy decisions, especially when it comes to advertising, marketing, and providing a robust online learning environment for students and their teachers. In conclusion, we explore implications of our work and provide future research directions that could be useful as educational research continues to investigate the impact of COVID-19 on K-12 school districts and online learning.
1 Study Design

Our guiding research question was the following: In what ways do Texas K-12 school district websites compare regarding several digital web metrics? To answer this question, we visited 764 individual K-12 school district websites and used SEMrush (2020) to capture several digital web metrics that could provide insight on how K-12 school districts leveraged their online presence to facilitate online learning during COVID-19.

2 Definitions of Digital web Metrics

Using prior research into higher education websites as a foundation (Taylor & Bicak, 2020), we gathered several digital web metrics related to the visibility, popularity, and investment of a K-12 school district website. Our variables included organic keywords, which are the number of unique search terms that web users naturally (or organically) enter in a search field (e.g., performing a Google search) to generate search results. For example, a web user may enter “Texas public schools” and see https://tea.texas.gov on the search results page. We then calculated the average number of unique organic keywords per month, representing a measure of web popularity and investment through search engine optimization (SEO). Websites that feature better SEO often have higher numbers of organic keywords that lead to a search result and subsequent click on the website’s hyperlink, and professional SEO work is expensive and time-intensive (Taylor & Bicak, 2020). Organic keywords also reflected the popularity of a website by the number of searches, as well as the SEO of a website by the number of organic keywords that have been entered into the metadata of a website’s markup language (e.g., HTML 5, Java, CSS).

Another variable, organic traffic, is an extension of organic keywords, but is the average number of monthly visitors trafficking a website after entering an organic keyword and clicking on a search result from that organic keyword search (e.g., an web user entering “Texas public schools,” seeing https://tea.texas.gov on the search results page, and then clicking on https://tea.texas.gov). For our study, organic traffic can be conceptualized as a measure of web popularity, investment through SEO, and visibility.

In addition, capturing traffic cost allowed us to analyze the monthly cost incurred to the website administrator to facilitate search results placement on the Google search engine and host the web traffic on a school district’s local server (Childs & Taylor, 2021, 2022; Taylor & Childs, 2020). We also captured webpages, which are the number of unique web-pages embedded on an overall website. For example, Houston Independent School District’s (HISD) landing page (https://www.houstonisd.org/) contained multiple individual webpages such as information about how parents can enroll their children (https://www.houstonisd.org/enroll) and the HISD School Board (https://www.houstonisd.org/board). This produced a measurement for website size and visibility, as larger and more expensive websites contain more webpages, which can become more visible through search engines such as Google or Bing (Alsmadi & Taylor, 2019; Childs & Taylor, 2021, 2022). Moreover, larger websites may feature larger or more robust online learning platforms (such as Canvas or Blackboard) that could give students in certain school districts an educational advantage over districts that do not use or cannot afford these robust learning platforms (Alsmadi & Taylor, 2019; Taylor et al., 2019).
Finally, we measured for backlinks, which represent the presence of a website’s URL(s) or hyperlink(s) on another website (e.g., https://www.houstonisd.org/ appearing on the TEA’s website at https://tea.texas.gov). Backlinking is an additional measure of a website’s popularity and visibility, as websites with greater numbers of backlinks may be more visible on search results pages depending on the organic keywords entered by the web user and the investment in the SEO of the website (Alsmadi & Taylor, 2019; Taylor et al., 2019).

As SEMrush (2020) is a relatively new and novel data collection and analytic tool, Fig. 1 below provides a snapshot of the SEMrush dashboard after analyzing Austin Independent School District’s (Austin, TX) website (www.austinisd.org).

### 2.1 Data Analysis

Descriptive statistics of web metrics of Texas K-12 school district websites from August to October 2020 can be found in Table 1 below:

Directly addressing this study’s sole research question, data in Table 1 suggest that Texas school district websites experience different levels of organic search and traffic, spend differently to support web traffic, and feature varied webpage and backlink numbers. To begin, major urban, major suburban, and other central city school districts are much more popular online by organic keywords, as major urban districts experience roughly 59,000 organic keywords resulting in a click on that school districts website per month, more than all other school district types combined. In this regard, this data clearly suggests school districts situated in populous areas may be more likely to be more popular online or that students in major urban school districts may have more access to the Internet than peers attending other school district types. However, major urban districts also had the largest standard deviation in terms of organic keywords (42,308), suggesting that major urban districts do greatly vary in their web popularity by organic keyword.

The online popularity of a school district may translate to organic traffic as well, as major urban districts far outpaced all other school district types by organic traffic every month. Major urban districts experienced nearly 300,000 hits of organic traffic on their website monthly, whereas rural districts experienced fewer than 1,000 hits of organic traffic on their websites. Overall, major urban, major suburban, and other central city school districts in Texas were much more popular than peers across organic keywords an organic traffic metrics, suggesting that physical population among these geographic settings may translate to

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Fig. 1 Screenshot of the SEMrush data gathering dashboard, analyzing www.austinisd.org
online popularity. As a result, online competition between urban and rural districts may have been exacerbated by the COVID-19 pandemic and the shift to online learning, especially as Texas is an open enrollment K-12 education system with many charter schools being online-only (Childs & Taylor, 2022).

Another measure of web popularity is backlinks, or, the presence of one’s hyperlink on another website. As was the case regarding organic keywords and organic traffic, major urban, major suburban, and other central city school district websites were much more popular in terms of backlinking than peers, suggesting that the web footprint of these school districts is much larger than other school district types. Here, data suggests that K-12 school districts in urban areas are more popular by web user tendencies (organic keywords and organic traffic), and these districts are also more popular among other websites (backlinks). From here, data in Table 1 clearly suggests that K-12 school districts in urban areas publish websites which are much more popular and thus much better positioned to share information about school district offerings and educational opportunities than other school district types.

Finally, the metrics of traffic cost and web pages are both proxies for how much a school district invests in their website, as it is expensive to host web traffic on servers as well as support web developers and content creators to publish individual web pages on a school district website (Taylor & Childs, 2020; Childs & Taylor, 2022). Just as major urban, major suburban, and other central cities were more popular on the web than peers, this popularity may have come at a cost. Major urban school districts on average spent $468,313 monthly

| District Type                  | Organic Keywords | Organic Traffic |
|-------------------------------|------------------|-----------------|
| Charter School                | 1,215            | 3,376           |
| Rural                         | 679              | 889             |
| Independent Town              | 3,360            | 7,191           |
| Other Central City            | 15,983           | 60,020          |
| Other Central City Suburban   | 5,720            | 13,551          |
| Non-Metropolitan, Fast Growing| 1,898            | 3,102           |
| Non-Metropolitan, Stable      | 1,745            | 3,259           |
| Major Suburban                | 17,585           | 75,661          |
| Major Urban                   | 59,824           | 289,437         |
| Sample (n = 764)              | 4,950            | 17,444          |

| District Type                  | Traffic Cost | Webpages | Backlinks |
|-------------------------------|--------------|----------|-----------|
| Charter School                | 5,219        | 177      | 4,004     |
| Rural                         | 419          | 158      | 419       |
| Independent Town              | 4,004        | 678      | 4,004     |
| Other Central City            | 74,905       | 2,485    | 74,905    |
| Other Central City Suburban   | 12,734       | 986      | 12,734    |
| Non-Metro, Fast Growing       | 3,161        | 382      | 3,161     |
| Non-Metro, Stable             | 1,749        | 387      | 1,749     |
| Major Suburban                | 99,340       | 2,706    | 99,340    |
| Major Urban                   | 468,313      | 8,124    | 468,313   |
| Sample (n = 764)              | 22,314       | 810      | 22,314    |
on their web traffic costs compared to rural school districts spending only $419 a month on the same expense.

Major urban websites were also much larger than peers, as the average major urban website was nearly three times larger (8,124 webpages) than major suburban websites (2,706 webpages) and thousands of pages larger than many other school district websites in this study. As a result, school districts with more spending power, such as major urban districts, may be better able to build larger, more popular, and better search engine optimized websites than peers. This implies that urban districts may be stratifying the educational market, as information on major urban websites is much more visible and much more popular than smaller, less web popular school district types. Additionally, wealthier districts or online savvy districts may be investing more in their website and SEO, resulting in a more robust, accessible, and detailed learning environment for students and teachers.

Although these numbers are not tied to outcome variables and are not part of a longitudinal dataset to infer causality, these digital web metrics do suggest that district websites may drastically differ across these metrics, depending on school district type, size, or location. As a result, these results hold promise for future educational research into the digital web metrics of school district websites, possibly informing how school districts compete online, influence the decision-making processes of diverse educational stakeholders, and conduct online learning. These findings are especially in a COVID-19 era where most of school district information and curricular content is being delivered virtually. In no uncertain terms, K-12 students across the country have been forced to learn online, yet many of students may not have access to a robust online learning environment depending on their school district’s web investment.

3 Discussion and implications for Methodology, Policy, and Pedagogy

Evidenced by the data in Table 1, there are considerable differences regarding the organic keyword volume, organic traffic, traffic cost, number of webpages, and number of backlinks of K-12 school district websites in Texas. In an expanding market of charter school and online school operations (Childs & Taylor, 2022; Jabbar, 2015), these digital web metrics will likely inform educational researchers as to how school districts compete online and facilitate teaching and learning, in addition to how different school districts invest in their website and web presence, including how learning environments may vary in size, visibility, and quality.

First, regarding methodology, future research ought to further investigate how K-12 school districts invest in their website and other forms of digital communication, such as keyword or banner advertising online, social media, and creative content (e.g., videos, audio). Prior research has demonstrated that K-12 school districts must facilitate a robust web presence to recruit and retain both students and teachers (Childs & Taylor, 2022; Jabbar, 2015; Jones & Figueiredo-Brown, 2018), while learning environments have become increasingly complex and important for student access to education during the COVID-19 pandemic (Borup et al., 2020). Here, researchers could utilize technologies such as SEMrush to explore how school districts compete with one another, how schools build websites and digital platforms to facilitate teaching and learning, and how changes in a school or school district’s digital metrics influences student enrollment, teacher retention, or any
other number of factors critical to a school district’s success. Moreover, researchers could compile longitudinal datasets gathering the same digital metrics to uncover how school districts leverage Internet technologies to survive. As data in our study clearly indicate, larger and potentially wealthier school districts may be better able to host traffic (spend on traffic cost) and build larger websites to increase their online popularity and visibility, potentially obscuring or hiding the school district content of competitors, especially those from smaller and less resourced school districts.

Focused on policy, both practitioners and researchers ought to advocate for equitable funding policies especially as it pertains to how K-12 school districts build digital resources and facilitate teaching and learning. In a COVID-19 environment where school district budgets may be tightened and teacher shortage may be problematic for many school districts across the country, policymakers ought to investigate and understand how K-12 school districts could be supported through funding policies that equitably distribute resources to school districts who may not be well positioned to compete with wealthier peers. Data in this study suggests considerable stratification between urban districts and rural districts regarding many digital metrics, implying that rural districts may not have the human or financial resources to maintain pace in an ever-changing digital landscape of K-12 education. Additionally, policymakers should inquire about what it means for a school district—both symbolically and financially—to spend nearly $500,000 per month to drive traffic to their website, as data in this study suggests. These expenses should be intensely scrutinized when these school districts maybe be struggling pay for and recruit high-quality teachers, potentially limiting the district’s educational offerings for students and the quality of students’ online learning environments.

Finally, considering pedagogy, the COVID-19 pandemic amplified many of the inequities facing the U.S. K-12 school system, mainly that wealthier school districts may have resources that manifest in both physical and digital stratification. The COVID-19 pandemic demonstrated that wealthy districts may be more likely to weather crises in state and local K-12 budgets while providing an elevated level of education that less wealthy, poorly resourced districts can provide their students (Baker et al., 2020). Simply put, teachers cannot use resources and training that their district does not provide, and school districts providing a robust online learning environment for both students and teachers is essential in an era where online or hybrid learning may be a permanent fixture within a student’s daily schedule. For these reasons, investigation into how K-12 school districts invest in online learning technologies—including the investment in and robustness of their website—is crucial to understand where K-12 school districts spend their money and whether that investment is translating into student learning and development.

4 Conclusions

Ultimately, as school districts have increased their marketing, advertising, education operations, and overall online presence over the past twenty years (Childs & Taylor, 2021, 2022; Jones & Figueiredo-Brown, 2018), studying the impact of this shift becomes critical to understanding the influence and utility of the Internet is when it comes to teaching and learning. As more schools and districts rely on educational technology and the Internet for advancing their educational practices and offerings, further understanding of the digital
environment is crucial for policymakers, practitioners, and researchers to make decisions and evaluate students’ access to robust digital learning environments. Although the Internet and online learning is a fairly new and novel concept considering the overall history of formalized education in both U.S. and non-U.S. settings, technology has advanced to the point where digital metrics can be evaluated now to inform change now and into the future. Educators must embrace new evaluation technologies such as SEMrush to help stem educational inequities and better understand how teachers teach and students learn, whether the environment is physical and digital.

Declarations

The authors declare no competing interests.

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References

Alsmadi, I., & Taylor, Z. W. (2019). Does size matter? An evaluation of institutional Internet ranking metrics. *Technology & Resources in Education, 1–24*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3441943

Baker, B. D., Weber, M., & Atchison, D. (2020). Weathering the storm: School funding in the COVID-19 era. *Phi Delta Kappan, 102*(1), 8–13. https://doi.org/10.1177%2F0031721720956839

Borup, J., Jensen, M., Archambault, L., Short, C. R., & Graham, C. R. (2020). Supporting students during COVID-19: Developing and leveraging academic communities of engagement in a time of crisis. *Journal of Technology and Teacher Education, 28*(2), 161–169. https://www.learntechlib.org/primary/p/216288/

Childs, J., & Taylor, Z. W. (2021). Do charter schools outspend public schools online? Evidence from Texas. *Journal of School Choice, 1–20*. https://doi.org/10.1080/15582159.2021.1944737

Childs, J., & Taylor, Z. W. (2022). (Digitally) connecting students, schools, and districts: Measuring the size and popularity of K–12 public and charter school district websites. *Journal of Education, 1–13*. https://doi.org/10.1177%2F00220574221088495

Jabbar, H. (2015). “Every kid is money”: market-like competition and school leader strategies in New Orleans. *Educational Evaluation and Policy Analysis, 37*(4), 638–659. https://doi.org/10.3102%2F0162373715577447

Jones, K. D., & Figueiredo-Brown, R. (2018). Finding the customers: Challenges and experiences marketing K–12 full-time virtual schools. *American Journal of Distance Education, 32*(2), 96–112. https://doi.org/10.1080/08923647.2018.1440463

SEMrush (2020). SEMrush: A service for marketing professionals. Retrieved from https://www.semrush.com

Taylor, Z. W., Childs, J., Bicak, I., & Alsmadi, I. (2019). Is bigger, better? Exploring U.S. News graduate education program rankings and Internet characteristics. *Interchange, 50*(2), 205–219. https://doi.org/10.1007/s10780-019-09366-0

Taylor, Z. W., & Bicak, I. (2020). Buying search, buying students. How elite U.S. institutions employ paid search to practice academic capitalism online. *Journal of Marketing for Higher Education, 1–26*. https://doi.org/10.1080/08841241.2020.1731910

Taylor, Z. W., & Childs, J. (2020). Are the rich getting richer? How school district wealth predicts website traffic expenditures. *Texas Education Review, 8*(2), 53–69. https://doi.org/10.26153/tsw/9203

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