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Using Roadmap-Formatted Curriculum in Elementary School to Improve NWEA Reading Growth

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The study investigates the impact of Roadmap-formatted curriculum on student reading growth in grades 3-5 in the Ypsilanti Community Schools (Ypsilanti, MI). Classrooms in grades 3-5 were divided into two groups: those using the Roadmap-formatted, commercially-provided curriculum and those using the same commercially-provided curriculum in traditional format (e.g., primarily paper-and-pencil format.) Results, measured via NWEA Reading Conditional Growth Percentiles (CGP), revealed a 9-percentage-point improvement in reading growth among students whose teachers who used Roadmaps-formatted curriculum with their students. These findings suggest that deeply-digital, interactive curriculum significantly enhance reading achievement, aligning with contemporary digital learning theories and addressing the needs of Generation Alpha learners.

INTRODUCTION

Educational technology's evolution has transformed teaching, requiring educators to adopt "deeply-digital curricula" that "provide a richer and more engaging experience through interactive components, videos, simulations, hyperlinks to additional resources, graphics elements, assessments that gauge student interest and comprehension, and much more" (PCAST, 2010, p. 77). These deeply-digital resources are particularly suited to digital-first, Alpha Generation students that populate today's classrooms. GenAlphas, immersed in technology from birth, have distinct learning preferences that traditional methods fail to engage effectively (McCrindle & Fell, 2020; Norris et al., 2021). The study reported on here addresses the gap in understanding the impact of deeply-digital curricula on reading growth for Alpha Generation learners in upper elementary school in underserved communities.

More specifically, this paper reports on a study, based on data from 2023-24, illustrating reading growth of students in grades 3-4-5 in Ypsilanti Community Schools (YCS), Ypsilanti, MI, a district that serves a predominantly low socio-economic status (SES) student population (National Center for Education Statistics, n.d.; Owens & Candipan, 2019; SchoolDigger, n.d.) Teachers and students in those grades used a highly-regarded, commercial, ELA curriculum. However, one group used a deeply-digital version of that ELA curriculum (implemented as Roadmaps – see below), while another group used the ELA curriculum as provided by the publisher (i.e., predominantly paper-based but with some digital elements). The former group demonstrated reading growth 9+ Percentage Points higher than the latter group as measured by the NWEA Reading Conditional Growth Percentile (CGP). This significant gain in reading growth can be attributed, in large measure, to the GenAlphas using the deeply-digital, Roadmap-formatted version of the commercial ELA curriculum. As documented in sections below (see Theoretical Framework, Literature Review) this conclusion is supported by a review of current scholarly literature on deeply-digital learning, multimodal instruction, and personalized instruction.

THE CONTEXT

Description of Roadmap-Formatted ELA Curricula

To better address the needs of its digital-first, GenAlpha students in grades 3-4-5, YCS teachers from those grades, with support from the University of Michigan's Center for Digital Curricula (UMichCDC), converted their purchased commercial ELA curriculum into the deeply-digital, Roadmap format. Figure 1 illustrates Module 4, Grade 4 of their ELA curriculum in the Roadmap format. A Roadmap is essentially a "concept map" (Torre et al., 2013) where the nodes are interactive, e.g., when a teacher clicks on the node numbered 2 (Figure 1), the Roadmap in Figure 2 is displayed in the teacher's browser (e.g., Chrome) window. Similarly, clicking on node 6 in Figure 2 opens the Roadmap in Figure 3 in another window in the browser. Roadmaps are designed to include other Roadmaps, creating a nested structure.

The Roadmap in Figure 3 represents the "student facing" version of a lesson that a teacher can send to their class, enabling students to access individual lessons and learning activities by clicking on nodes. For example, when a student clicks on node 4 (Figure 3), the Roadmap of learning activities in Figure 4 opens up in the student's browser window. Clicking on the node "Decoding" (Figure 4) opens up the drawer on the left providing the student with instructions.

In the "teacher-facing" version of a Roadmap (Figures 1 and 2), teacher-specific nodes (e.g., "Week 2 at a Glance") which contain teaching tips and lesson plans are hidden from students by the placement of "apple icons." Essentially, a teaching-facing Roadmap serves as a "one-stop shop," providing virtually everything a teacher needs to conduct a lesson. Similarly, a student-facing Roadmap contains all the information students need to enact a lesson from start to finish. Importantly, by enabling students to navigate an *entire lesson* independently, the student-facing Roadmap supports student agency (Palincsar, 1998; Vygotsky, 1978), giving students control over their progress through the lesson.

By clicking on the plus (+) in the tool bar (Figure 1) to the left of a Roadmap, a teacher can create a Roadmap; clicking on the wrench in the tool bar displays the Roadmaps in a teacher's personal library, while clicking on the spyglass opens the public library of Roadmaps (currently there are over 1200 Open Education Resource (OER, UNESCO, 2019) Roadmaps. Teachers can easily modify an existing Roadmap, e.g., adding/deleting a learning activity, or adding a document/video that they have used before.

Roadmaps are hosted on the Roadmap Platform, which is in turn, hosted on the Google Cloud Platform (GCP). The Roadmap Platform supports teachers' distributing Roadmaps to their students and monitoring, in real-time, students working through their Roadmaps. Additionally, for students, the Roadmap Platform provides a range of accommodations (e.g., an AI VoiceBot can read instructions to students *in their teacher's voice* – see the speaker icon in the drawer in Figure 4), scaffolds (e.g., GenAlphas can respond to questions in a Roadmap via voice, video as well as text), and applications specifically designed for GenAlphas (e.g., Flipbook supports learners creating animations). The Roadmap Platform also supports synchronous collaboration (e.g., students/teachers can work on the same file and talk through the phone icon to each other using voiceover IP). In what follows, for the sake of simplicity, the term "Roadmaps" refers to the Roadmap Platform and the Roadmap lessons that the Platform hosts.

Figure 1

Example of a Teacher-facing, Roadmap-formatted, Commercial Curriculum: Module Level

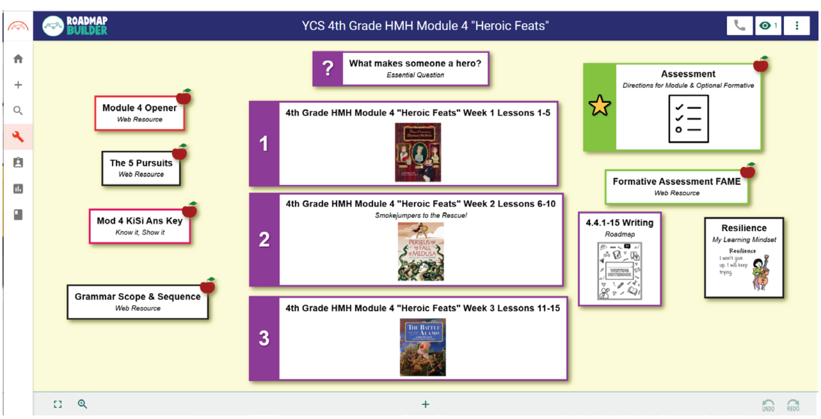


Figure 2

Example of a Teacher-facing, Roadmap-formatted, Commercial Curriculum: Lesson Level

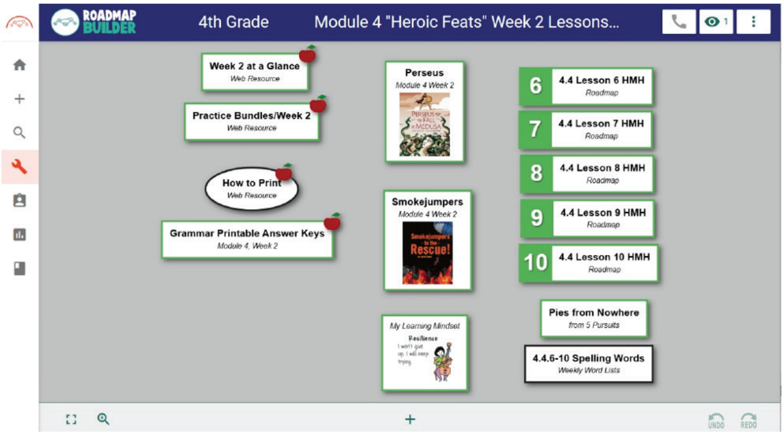


Figure 3

Example of a Student-facing, Roadmap-formatted, Lesson

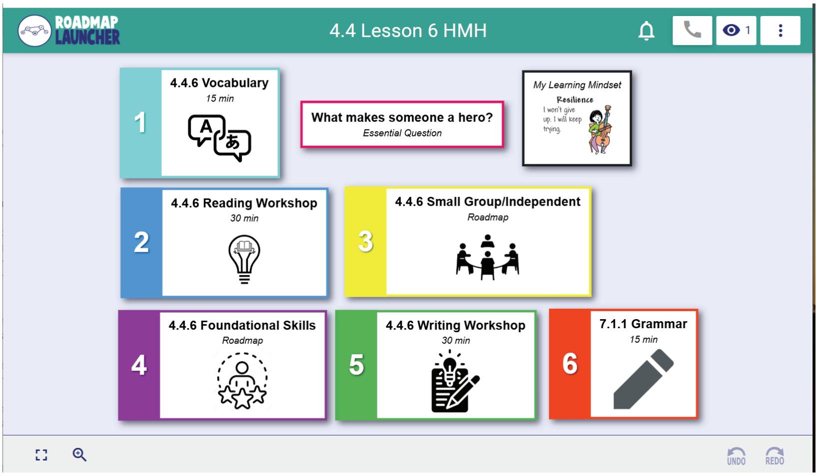
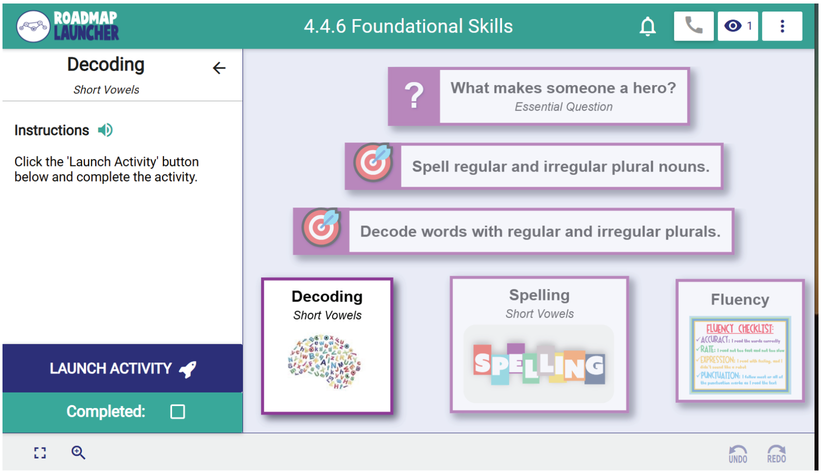


Figure 4

Example of a Student-facing, Roadmap-formatted, Set of Learning Activities



Roadmaps in Daily Use in Michigan's Elementary Schools

The Roadmap Platform hosts year-long, standards-aligned, deeply-digital OER (UNESCO, 2019) curricula for K-5 for English Language Arts, math, science, and social studies. Roadmap curricula have been used by students, primarily in Michigan, since 2019-20. Currently (2024-25), 4,000+ students and teachers are using those resources, daily. In addition, the UMichCDC has created OER curricula for the Electric Vehicle and Mobility area. Those "BrainVentures" – Roadmap lessons – contain not only the science and engineering of EV/Mobility but also provide learners with information about careers in the expanding EV/Mobility ecosystem in Michigan.

Virtually all the schools using Roadmaps in Michigan are in "low Socio-Economic Status" (SES) communities (UNESCO, 2019). Such schools face particular challenges in providing high-quality education, often lacking the resources needed to purchase commercial curricula. However, OER curricula in Roadmaps address these inequities by offering free, customizable curricula that are accessible to all students (UNESCO, 2019). Research by Darling-Hammond et al. (2020) emphasizes that equitable access to digital tools can help close the achievement gap in low SES schools. Roadmaps provide a viable solution for such schools, offering deeply-digital, standards-aligned content that teachers can easily adapt to meet their students' needs.

THEORETICAL FRAMEWORK

Social Constructivism and Active Learning

Roadmaps are rooted in social constructivist theories of learning, which emphasize that knowledge is constructed through interaction with others and the environment (Palincsar, 1998; Vygotsky, 1978). In classrooms, this means fostering collaboration, dialogue, and problem-solving activities. Roadmaps facilitate these processes by offering synchronous collaboration tools that enable real-time interactions among students, regardless of their physical location. These digital collaborations align with Vygotsky's (1978) concept of the "Zone of Proximal Development," where peer collaboration aids in advancing individual learning. Further, Svensson (2020) discusses how platforms like Google Classroom facilitate collaboration, engagement, and comprehension, which parallels Roadmaps' design philosophy that encourages student-driven exploration and peer-supported learning.

Moreover, Roadmaps embody Bruner's discovery learning approach, where students engage actively with content through exploration and inquiry. The interactive features of Roadmaps—such as visual lesson maps and node-based activities—encourage students to discover information, synthesize concepts, and apply their knowledge in new contexts, which is crucial for deep learning (Bruner, 1961).

Multimodal Learning and Cognitive Load Theory

The design of Roadmaps supports multimodal learning, which research shows can improve student understanding and retention (Bobek & Tversky, 2016). Multimodal learning, incorporating visual, auditory, and kinesthetic elements, is particularly important for digital-first generations like the Alphas, who are accustomed to consuming information through various media (Ferguson, 2020). Integrating videos, animations, and audio recordings into lessons reduces cognitive load by presenting information in digestible chunks (Sweller, 2011). As a result, Roadmaps allow students to process complex ideas more easily without overwhelming their cognitive capacities.

Multimodal learning environments have proven beneficial for reducing cognitive load and improving comprehension in digital-first learners. Yakovleva and Goltcova (2020) argue that effective digital instruction must balance diverse learning styles and motivational strategies to optimize engagement. The Roadmap design—combining visual, auditory, and kinesthetic elements—addresses this need by presenting content in digestible chunks, thereby reducing the cognitive strain on students. Similarly, Masyhura and Ramadan (2021) point to infrastructure limitations that can hinder digital curriculum implementation, underscoring the need for well-resourced multimodal platforms to maximize cognitive and academic benefits for students.

LITERATURE REVIEW

Digital Pedagogy and Student Engagement

The shift toward deeply-digital curricula has shown promising results in enhancing student engagement, especially among younger, tech-savvy generations. Studies have shown that digital-first students, like the Alpha Generation, require more interactive and engaging learning environments to maintain interest and motivation (Kahu, 2013; Twenge, 2017). Research by Ferguson (2020) indicates that students who are regularly exposed to digital content outside of school expect similar experiences in their academic environments, making traditional paper-based curricula less effective. Roadmaps' node-based lessons allow students to visualize their learning pathways and engage with the content actively, fostering higher-order thinking skills (Akinyemi et al., 2019).

The adoption of digital pedagogy is increasingly recognized for its effectiveness in enhancing student engagement. Kustini et al. (2020) demonstrate that multimodal pedagogy, which incorporates various digital literacy skills, significantly boosts engagement in low-SES school environments. This finding aligns with the interactive, deeply-digital approach employed by Roadmaps, suggesting that integrating multimedia resources can better sustain student interest compared to traditional, paper-based methods.

Impact of Technology on Learning Outcomes

Meta-analyses of digital learning environments have shown that technology-rich classrooms lead to improved learning outcomes when appropriately integrated (Hattie & Timperley, 2007). A study by Cheung & Slavin, (2013) revealed that digital tools used in elementary schools were particularly effective in improving reading and math scores. This finding is echoed in the current study's data from Ypsilanti Community Schools, where consistent use of Roadmaps significantly improved reading growth in grades 3 through 5.

METHODS

Study Context

This study was conducted during the 2023–24 school year at Ypsilanti Community Schools (YCS), Ypsilanti, MI, focusing on a mid-high poverty area where 50.5% of students qualify for federal free and reduced-price meals (NCES.ED.GOV, 2023). The research was approved by the Institutional Review Board (IRB) of Saginaw Valley State University (2022), ensuring adherence to all ethical standards.

Data Collection

The data reported in Table 1 were obtained from NWEA tests administered in the Fall and Spring of the 2023–24 school year

Table 1

Teachers and students in YCS who participated in the study reported here

Grades 3-4-5 in YCS:		
	Users	**Non-Users**
Students	270	388
Teachers	14	22

Additionally, qualitative data from teacher surveys collected in June 2024 from the YCS teachers (grades 3-4-5) provided insights into their perceptions of Roadmaps and their impact on student engagement and achievement. Teachers reported on the ease of integrating Roadmaps into their instruction, student engagement levels, and the platform's influence on student behavior and performance.

The qualitative responses were systematically analyzed to identify key themes, which are summarized in Table 2. These themes highlight teachers' perspectives on Roadmaps' integration into the classroom, their role in enhancing student engagement, and their impact on instructional ease and academic outcomes.

Table 2

Key Themes from Teacher Survey Feedback

Category	Key Findings
Ease of Use	72% of teachers rated the Roadmap Platform as 'very easy to use'.
Time Savings	65% of teachers reported significant time savings in lesson planning and classroom preparation, with additional benefits like streamlined management.
Engagement	72% of teachers observed high student engagement with Roadmaps.
Achievement Impact	73% of teachers believed that Roadmaps significantly increased student achievement.

Study Design and Participant Categorization

The UMichCDC has been investigating the impact of Roadmap-based curricula use on student achievement across multiple curricular areas (e.g., English Language Arts, mathematics, social studies, and science) in Michigan elementary schools since 2019-20. These data suggest that consistent use of Roadmaps, defined as at least two active days of teacher engagement with the Roadmap Platform per week, is associated with greater levels of student achievement.

For the current study, teachers in grades 3-4-5 in Ypsilanti Community Schools (YCS) and their students (Table 1) were categorized into two groups based on the frequency of teacher engagement with the Roadmap Platform:

1. **User Group:** Teachers who registered at least two active days of Roadmap Platform use per week.
2. **Non-user Group:** Teachers who registered fewer than two active days of Roadmap Platform use per week.

This categorization provided a framework for analyzing differences in student outcomes based on the consistent use of the Roadmap Platform with their students.

Statistical Significance Analysis

The Independent T-Test (Two-Sample T-Test) was used to evaluate statistical significance. The Independent T-Test is commonly used for comparing the means of two independent groups (students using a new learning method vs. control), assuming test scores are continuous, approximately normally distributed, and sample sizes are not small. This analysis compares NWEA Fall test scores to Spring test scores to determine reading growth in the 2023/24 school year for grades 3, 4, 5 at YCS.

Hypothesis

A significance level of 5% was selected. The following Null Hypothesis was used. The conditional growth index (CGI) is an indicator of how much individual student growth deviates from the student growth norms.

- H_0: Use of Roadmap-formatted curricula have no effect on average NWEA Reading CGI
- H_1: Use of Roadmap-formatted curricula increase average NWEA Reading CGI

Data

The test was conducted for grades 3, 4, 5. The Independent T-Test was calculated for the User Group with a mean CGI of -0.0486 (48.06%), sample size of 270, and standard deviation of 1.3425 and the Non-user Group with a mean CGI of -0.2817 (38.91%), sample size of 388, and standard deviation of 1.4579.

Equation

Test Statistic Calculation:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

- $\bar{X}_1, \bar{X}_2$ = Means of the two groups
- s_1, s_2 = Standard deviations of the two groups
- n_1, n_2 = Sample sizes of the two groups

The t-value was calculated to be 2.114.

Sample Size

The degrees of freedom were approximated using the following equation.

$df \approx n1 + n2 - 2 = 270 + 388 - 2 = 656$

Confidence Level

The p-value was calculated with the following inputs: t-value = 2.114, Degrees of Freedom = 656, and one-tailed test, resulting in a p-value = 0.0174 and a confidence level of 98.26%. Thus, there is a statistically significant difference in the mean test scores between User Group and Non-user Group of Roadmaps. The mean CGP of the User Group was at the 48th Percentile while the mean CGP of the Non-user Group was at the 39th Percentile, resulting in a difference of 9 Percentile Points.

The findings from this study are consistent with broader research showing that digital resources can improve educational outcomes and address equity issues in low-SES schools. Lee et al. (2018) found that digital textbooks positively impact students' academic performance and learning engagement, particularly among low-achieving students. This reinforces the effectiveness of Roadmaps in boosting reading growth for students in low-resource environments. Similarly, Pratiwi and Sampelolo (2022) emphasize the motivational benefits of digital literacy programs tailored for low-SES contexts, which foster greater student autonomy and active engagement.

These studies collectively support the assertion that Roadmap-formatted curricula offer a practical and equitable solution for enhancing educational outcomes in economically disadvantaged communities.

DISCUSSION

The analysis above shows that students using Roadmap-formatted, commercial curricula achieved a 9-percentile-point improvement in reading growth compared to students using the same commercial curricula but in its traditional format (e.g., primarily paper-and-pencil). This improvement demonstrates the potential of deeply-digital curricula on the Roadmap Platform to enhance educational outcomes in underserved settings. These results demonstrate that consistent use of Roadmaps can lead to measurable improvements in student growth, particularly in underserved communities.

Three key factors appear to contribute to the success of Roadmap-formatted curricula:

- **Engagement and Motivation:** The graphical and interactive design of Roadmaps keeps students engaged, aligning with findings from studies on student motivation in digital learning environments (Ferguson, 2020; Kahu, 2013). In the teacher survey, teachers reported that students were more likely to stay on task, leading to fewer behavioral issues and higher academic performance.
- **Differentiation and Personalization:** Roadmaps' flexibility enables teachers to modify lessons to meet the needs of individual students, which is a key feature of differentiated instruction. This aligns with Tomlinson's (2001) theory that personalized learning improves student outcomes, particularly in diverse classrooms.
- **Collaborative Learning:** Roadmaps support students in collaborating synchronously, in real-time, whether in-person or remotely. In turn, this functionality cultivates critical thinking and problem-solving skills and is consistent with social constructivist approaches to learning (Palincsar, 1998).

Considering that the NWEA Reading Conditional Growth Percentile (CGP) for grades 3-4-5 in 2022-23 was 38.48%, which is substantially similar to the NWEA Reading CGP for the Non-Users Group in 2023-24 of 38.92%, it can be concluded that neither student differences nor teacher differences accounted for the significant gains shown by the group using the Roadmap-formatted curricula.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings.

- First, the research was conducted in a single district, Ypsilanti Community Schools, which may limit the generalizability of the results to other contexts.
- Second, the qualitative data relied on teacher self-reports, which can be subject to biases such as overreporting successes or underreporting challenges.
- Third, the duration of the study was limited to one academic year, which may not capture the long-term effects of using Roadmap-formatted curricula.
- Fourth, the study did not account for potential variations in teachers' experience with digital tools, which could influence the effectiveness of the curriculum.

Future research should address these limitations by expanding the study to include multiple districts, longitudinal data, and controlled comparisons of teacher professional development.

CONCLUDING REMARKS

The results from Ypsilanti Community Schools indicate that Roadmap-formatted curriculum played a significant role in improving in reading growth. This study demonstrates the clear advantages of deeply-digital curricula, particularly when addressing the educational needs of the GenAlphas, who thrive in interactive and multimodal learning environments.

Looking forward, future research will examine the long-term impacts of Roadmaps across various subjects and grade levels. Expanding the use of Roadmaps into areas such as mathematics, science, and social studies will provide a more comprehensive understanding of their potential to impact teaching and learning. Additionally, further investigation into the professional development needs of teachers utilizing deeply-digital curricula, e.g., Roadmaps, will be crucial to ensure successful implementation. The ongoing study of deeply-digital, Roadmap curricula use in diverse contexts will continue to illuminate the pathways to effective education in the digital age.

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