

**Measuring the Impact of Structured Technology Routines on
Student Independence in Kindergarten: A Review of the Literature**

Angela M. Rios Zuluaga

Lamar University - EDLD 5315

Dr. Kristi Meeuwse

March 1, 2026

Planning Your Action Research Literature Review

Describe your overall topic, why it is important, and why you are interested in it:

The integration of educational technology in early childhood classrooms has become increasingly common; however, the effectiveness of these initiatives depends largely on how intentionally they are designed and measured. In kindergarten settings, technology is often introduced to support engagement and skill development, yet many implementations focus primarily on access rather than meaningful instructional impact (National Association for the Education of Young Children [NAEYC] & Fred Rogers Center, 2012).

This topic is particularly important because kindergarten students are still developing foundational self-regulation, independence, and problem-solving behaviors. Measuring the impact of structured technology routines requires developmentally appropriate strategies that prioritize observable behaviors such as time on task, frequency of teacher interruptions, and structured classroom observations (Blackwell et al., 2014; McAfee et al., 2016).

My interest in this topic emerges directly from my professional context implementing *Tech Time: My Time in Kindergarten*, a structured digital routine designed to promote student independence during math instruction. While initial implementation revealed improvements in engagement, a clear and systematic measurement framework is necessary to determine whether structured digital routines meaningfully increase independence (Zimmerman, 2002; Blair & Raver, 2015; Adler et al., 2025).

List any major themes, subtopics, or trends in research questions, methodologies, results, and/or conclusions:

The review of the literature revealed several recurring themes across research questions, methodologies, and conclusions related to technology integration in early childhood classrooms:

- Intentional technology integration aligned with instructional goals rather than device access
- Student independence and self-regulated learning (SRL) as foundational outcomes
- Engagement and time-on-task as observable behavioral indicators
- Developmentally appropriate measurement strategies for young learners
- Use of digital data, classroom observations, and learning analytics to support triangulation

THEME A: Intentional Technology Integration in Early Childhood

Overview of characteristics of the theme:

The literature consistently defines technology integration as intentional instructional design rather than simple access to devices (Puentedura, 2014; NAEYC & Fred Rogers Center, 2012). Effective integration aligns digital tools with pedagogy, developmental readiness, and structured routines.

Sub-topic 1: Definition and Alignment

Study 1:

NAEYC & Fred Rogers Center (2012)

Defines developmentally appropriate technology use in early childhood.

Study 2:

Puentedura (2014)

Conceptualizes levels of integration and instructional transformation.

Study 3:	Harapnuik et al. (2018) Emphasize meaningful learning environments that support engagement and ownership.
Sub-topic 2: Instructional Models	
Study 4:	Horn & Staker (2015) Blended learning structures that balance guidance and independence.
Study 5:	Darling-Hammond et al. (2014) Technology must enhance instructional quality and equity.
Study 6:	Blackwell et al. (2014) Technology use is influenced by instructional context and teacher practices.

THEME B: Student Independence and Self-Regulated Learning

Overview of characteristics of the theme:

Independence in early childhood is closely tied to self-regulation, persistence, and structured routines. SRL develops through scaffolding, modeling, and gradual release (Zimmerman, 2002; Blair & Raver, 2015).

Sub-topic 1: Foundations of Self-Regulation

Study 1:	Zimmerman (2002) Framework of self-regulated learning.
Study 2:	Blair & Raver (2015) Developmental perspective on self-regulation in early learners.
Study 3:	Adler et al. (2025) Empirical evidence of SRL support in elementary smart learning environments.

Sub-topic 2: Structured Routines and Independence

Study 4:	Harapnuik et al. (2018) Structured environments promote ownership.
----------	--

Study 5:	Bebell & Kay (2010) Technology initiatives influence classroom flow and student behavior.
Study 6:	Emmer & Sabornie (2015) Classroom management structures increase student engagement and independence.

THEME C: Engagement and Measurement in Technology-Based Learning	
Overview of characteristics of the theme:	
Engagement is multidimensional and must be measured through observable indicators rather than self-report in early childhood settings.	
Sub-topic 1: Observational Measurement	
Study 1:	Wortham (2012) Assessment in early childhood must be developmentally appropriate.
Study 2:	McAfee et al. (2016) Observation-based documentation of young learners.
Study 3:	Mertler (2020) Action research emphasizes systematic measurement and triangulation.
Sub-topic 2: Engagement and Time-on-Task	
Study 4:	Drljević et al. (2022) Primary students showed increased engagement during structured digital interaction.
Study 5:	Darling-Hammond et al. (2014) Instructional alignment influences engagement.
Study 6:	Bebell & Kay (2010) Quantitative classroom-level impact of technology initiatives.
Sub-topic 3: Digital Data and Learning Analytics	

Study 7:	Rutherford et al. (2022) Learning analytics from mathematics software provide insight into engagement and instructional impact.
Study 8:	Harapnuik et al. (2018) Triangulation strengthens measurement validity.
Study 9:	Mertler (2020) Mixed-methods approaches improve classroom-based research rigor.

THEME D: Instructional Design and the Teacher's Role	
Overview of characteristics of the theme:	
The literature emphasizes that technology integration does not independently produce student independence. Instead, instructional design, classroom structure, and teacher facilitation determine the effectiveness of digital routines. In early childhood classrooms, structured environments and consistent expectations are foundational for promoting autonomy and engagement.	
Sub-topic 1: Classroom Management and Structure	
Study 1:	Emmer & Sabornie (2015) Emmer and Sabornie emphasize that structured classroom management systems support student engagement and reduce instructional interruptions. Their work highlights that predictable routines and clearly defined expectations foster independent behaviors in young learners.
Study 2:	Darling-Hammond et al. (2014) Darling-Hammond and colleagues argue that technology initiatives are most effective

	when embedded within strong instructional frameworks. Their findings suggest that instructional alignment and teacher guidance are critical for ensuring that technology enhances rather than disrupts learning.
Sub-topic 2: Intentional Design and Reflection	
Study 3:	Harapnuik et al. (2018) Harapnuik and colleagues emphasize the importance of intentional learning design, noting that meaningful integration requires purposeful planning and structured implementation rather than passive technology use.
Study 4:	Mertler (2020) Mertler highlights the role of reflective practitioners in evaluating instructional innovations. Through systematic action research, teachers can assess whether structured routines are achieving their intended outcomes.

SUMMARY AND IMPLICATIONS

This body of literature contributes to the broader field of education by emphasizing intentional technology integration and developmentally appropriate measurement strategies in early childhood classrooms. Across the research, technology is consistently defined as an instructional tool that must be aligned with pedagogy, structure, and student development rather than simply providing access to devices.

One of the primary strengths of this body of literature is its strong theoretical foundation in self-regulated learning, classroom management, and intentional instructional design. The research consistently supports the importance of structured routines, observable measurement strategies, and teacher reflection when implementing technology initiatives. Additionally, recent empirical studies

strengthen the literature by incorporating engagement measures and digital usage data, which provide more objective indicators of student behavior in technology-based environments.

However, several limitations remain. Much of the existing research focuses on upper elementary or secondary grade levels, with fewer studies centered specifically on kindergarten contexts. In addition, student independence is often examined as a secondary outcome rather than as a primary variable of interest. Some earlier literature also relies heavily on conceptual frameworks without providing classroom-level measurement strategies that are developmentally appropriate for young learners.

Importantly, the literature emphasizes that instructional design and the teacher's role significantly influence the success of structured digital routines. Technology alone does not generate independence; rather, intentional planning, classroom structure, and reflective practice shape how effectively students develop autonomy within digital learning environments.

Overall, while the literature provides strong theoretical and methodological guidance, it reveals a need for kindergarten-specific research that directly measures student independence as a primary outcome using observable and developmentally appropriate indicators. The current study addresses this gap by examining structured digital routines within an authentic kindergarten classroom context.

REFERENCES

- Adler, I., Warren, S., Norris, C., & Soloway, E. (2025). Leveraging opportunities for self-regulated learning in smart learning environments. *Smart Learning Environments*, 12, Article 6. <https://doi.org/10.1186/s40561-024-00359-w>
- Bebell, D., & Kay, R. (2010). One-to-one computing: A summary of the quantitative results from the Berkshire Wireless Learning Initiative. *Journal of Technology, Learning, and Assessment*, 9(2), 1–60.
<https://ejournals.bc.edu/index.php/jtla/article/view/1605>
- Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2014). Factors influencing digital technology use in early childhood education. *Computers & Education*, 77, 82–90.
<https://doi.org/10.1016/j.compedu.2014.04.013>
- Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology*, 66, 711–731.
<https://doi.org/10.1146/annurev-psych-010814-015221>
- Darling-Hammond, L., Zieiezinski, M. B., & Goldman, S. (2014). *Using technology to support at-risk students' learning*. Alliance for Excellent Education & Stanford Center for Opportunity Policy in Education.
<https://edpolicy.stanford.edu/library/publications/using-technology-support-risk-students-learning>

Dede, C. (2014). The role of digital technologies in deeper learning. In *Students at the Center: Deeper Learning Research Series*. Jobs for the Future.

<https://files.eric.ed.gov/fulltext/ED561254.pdf>

Drljević, N., Botički, I., & Wong, L. H. (2022). Investigating the different facets of student engagement during augmented reality use in primary school. *British Journal of Educational Technology*, 53(5), 1361–1388.

<https://doi.org/10.1111/bjet.13197>

Emmer, E. T., & Sabornie, E. J. (2015). Introduction to the second edition. In E. T. Emmer & E. J. Sabornie (Eds.), *Handbook of classroom management* (2nd ed., pp. 1–18). Routledge.

Harapnuik, D., Thibodeaux, T., & Cummings, C. (2018). *Creating significant learning environments*. Learning and Teaching Innovations.

https://www.harapnuik.org/?page_id=858

Horn, M. B., & Staker, H. (2015). *Blended: Using disruptive innovation to improve schools*. Jossey-Bass.

McAfee, O., Leong, D. J., & Bodrova, E. (2016). *Assessing and guiding young children's development and learning* (6th ed.). Pearson.

Mertler, C. A. (2020). *Action research: Improving schools and empowering educators* (6th ed.). SAGE Publications.

National Association for the Education of Young Children [NAEYC], & Fred Rogers Center for Early Learning and Children's Media. (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8*.
<https://www.naeyc.org/resources/position-statements/technology-and-interactive-media>

Puentedura, R. R. (2014). *SAMR: A contextualized introduction* [White paper]. Hippasus.
<https://www.hippasus.com/rrpweblog/archives/2014/01/15/SAMRABriefContextualizedIntroduction.pdf>

Rutherford, T., Duck, K., Rosenberg, J. M., & Patt, R. (2022). Leveraging mathematics software data to understand student learning and motivation during the COVID-19 pandemic. *Journal of Research on Technology in Education*, 54(suppl 1), S94–S131. <https://doi.org/10.1080/15391523.2021.1920520>

Wortham, S. C. (2012). *Assessment in early childhood education* (6th ed.). Pearson.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice*, 41(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2