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Technology–Grounded Self–Directed Learning Model for Gymnasium Classrooms: Implications for Education Policy

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Context and Motivation

- Rapid digital transformation in schools (European Commission, 2021).
- Shift from teaching to learner agency (Zimmerman, 2008; Pintrich, 2004).
- There is a growing need for evidence-based integration of technology and self-regulated learning processes (Molenaar, Azevedo & Järvelä, 2023; Panadero, 2017).

Policy Relevance

- Aligned with European Commission (2021): *DigCompEdu Framework* and UNESCO (2022): *Reimagining our Futures Together*
- Supports data-driven, inclusive, and resilient education.
- National initiative: Part of the national eSavivaldis project funded by the Lithuanian Research Council (2025).

Research Aim

Aim: Develop a Technology-Grounded Self-Directed Learning (TGSDL) model

Focus: Gymnasium classrooms (ages 15–18)

Goal: Integrate psychological, pedagogical, and technological perspectives (Zimmerman, 2008; Panadero, 2017)

Methodology

- Systematic **narrative** synthesis (2020–2025)
- 49 peer-reviewed European studies (Kubsch et al., 2025; Khalil et al., 2024)
- Databases: Scopus, Web of Science, ERIC, PsycINFO
- Thematic coding by CAMM dimensions (Cognitive, Affective, Metacognitive, Motivational)

Theoretical Framework

Technology-Grounded Self-Directed Learning (TGSM) integrates four major theories:

1. Bandura (1991) – Agency & Self-efficacy
2. Zimmerman & Pintrich – Cyclical SRL phases
3. Winne & Hadwin – COPES metacognitive architecture
4. Hadwin, Järvelä & Miller – Socially Shared Regulation (SSRL)

Theoretical assumptions

The Technology-Grounded Self-Directed Learning (TGSM) model combines four theoretical pillars integrated into one theoretical meta-framework:

Model	Key Idea	Significance for the TGSM Structure
Bandura (SCT)	Reciprocal determination among *person–behavior–environment*; self-efficacy as driver of agency	Provides the motivational foundation and supports the P–B–E layers of the TGSM model
Zimmerman (SRL)	Cyclical self-regulation phases: *planning – action – reflection*	*Establishes the metacognitive logic and dynamic learning flow*
Winne & Hadwin (COPES)	*Conditions – Operations – Products – Evaluations – Standards* framework	*Forms the data-driven analytical system underlying self-regulation and feedback loops*
Hadwin et al. (SSRL)	*Co-regulated and socially shared regulation of learning*	*Adds the collaborative dimension of social interaction, negotiation, and shared reflection*

Why choose these four models?

All four models were chosen because each provides a different but complementary perspective:

Bandura SCT – provides a framework for motivation and self-efficacy.
Zimmerman & Pintrich SRL phases – define a cyclical learning process.
Winne & Hadwin COPES – provides a metacognitive architecture for process diagnostics.
Hadwin, Järvelä & Miller SSRL – integrates the social, community aspect.
(Bandura, 1991; Zimmerman, 2008; Hadwin et al., 2011; Winne & Hadwin, 1998)

The model visualizes the dynamic interaction among motivational, cognitive, technological, and socio-ecological systems.

The TGSM framework presented here is a *conceptual synthesis* based on established models of self-regulated and socially shared regulation of learning (Bandura, 1991; Zimmerman, 2008; Winne & Hadwin, 1998; Hadwin et al., 2011). It serves as a theoretical proposal for further empirical validation.

Integrating Four Theoretical Models into the TGSM Framework

We aim to integrate four distinct theoretical models into a single framework – the **Technology-Grounded Self-Directed Learning (TGSM)** model – guided by the following principles:

1. **Complementarity:** Selected constructs complement and fill theoretical gaps across models.
   Example: Bandura's SCT adds a motivational dimension absent in the COPES framework.
2. **Cyclicality:** All models operate on cyclical logic (*planning → action → reflection*), ensuring conceptual compatibility.
3. **Operationality in Digital Environments:** Only constructs measurable or supportable by technology are included.
   Example: Learning analytics can track COPES products, SSRL episodes, and SCT-based self-efficacy patterns.
4. **Integration of Levels:** TGSM covers multiple regulation layers – *individual (SRL), interpersonal (co-regulation), and group (SSRL).*

TGSM Conceptual Foundation (2D model)

This 2D framework illustrates the conceptual foundation of the TGSM model.
It shows how motivational, behavioral, and environmental factors interact through self-regulated and socially shared learning processes.
The aim is to integrate personal agency, cognitive regulation, and technological mediation into one coherent structure that connects individual learning with the wider educational ecosystem.

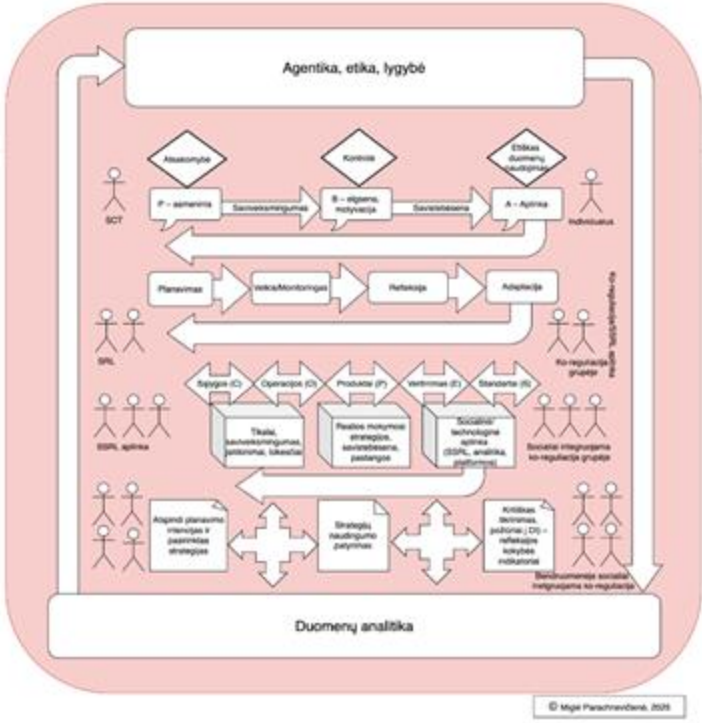


Figure 1. Based on Bandura's Social Cognitive Theory, Zimmerman's Self-Regulated Learning, and Hadwin's Socially Shared Regulation frameworks.

TGSM Dynamic Model (3D model)

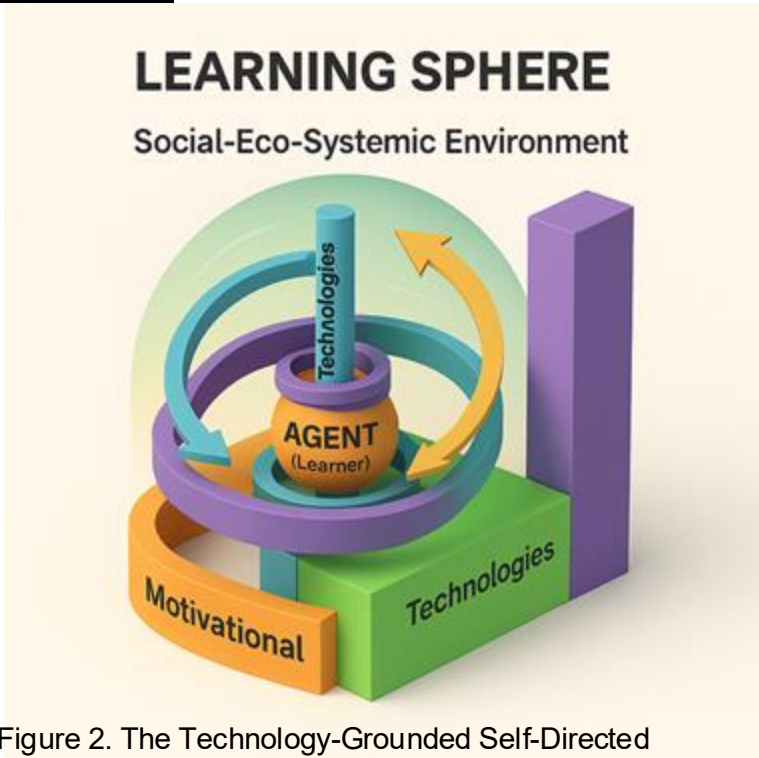


Figure 2. The Technology-Grounded Self-Directed Learning (TGSM) model — a conceptual synthesis integrating SRL, SSRL, and technological mediation theories.

TGSDL (TGSM) structure:

Core: Agent (Learner)

Helix: Plan → Act → Reflect

Vertical Axis: Technologies (AI, Analytics)

Outer Dome: Social–Eco-Systemic Environment

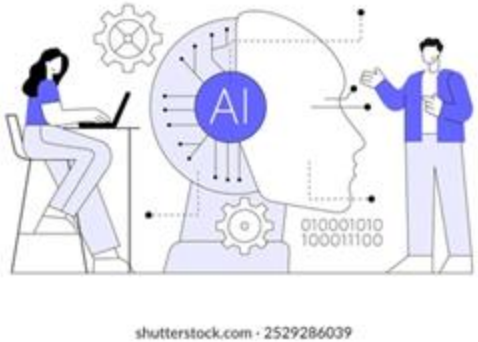
Optional visual connection (if you add legend to the 3D model figure):

Orange inner spiral → Motivation & Agency (Bandura)
Green mid spiral → Cognitive & Metacognitive Regulation (Zimmerman)
Blue axis → Technological Mediation / Data Analytics (Winne & Hadwin)
Violet outer layer / reflective halo → Socially Shared Reflection (Hadwin et al.)

A conceptual synthesis of SRL and SSRL frameworks; not an empirically validated model.

Key Findings

- Analytics detect SRL gaps → adaptive support
- Technology effective only when it empowers agency
- Socially shared regulation predicts learning quality
- Ethical data use and preservation of learner agency must guide all digital education initiatives (Khalil et al., 2024; Molenaar et al., 2023).



Implications for Education Policy

TGSM informs:

1. **Curriculum design** – integrating SRL & SSRL principles
2. **Teacher PD** – data literacy & reflective practice
3. **Assessment policy** – formative, analytics-based evaluation

(European Commission, 2021; UNESCO, 2022)

Conclusion

- TGSDL unites psychology, pedagogy & technology
- Strengthens learner agency and reflection
- Bridge between classroom data and policy
- Empirical validation ongoing (Lithuania 2025–2026) (Panadero, 2017)

Future Directions

Future Directions for TGSDL Research and Practice

1. **Empirical Validation** – Pilot testing in Lithuanian gymnasiums (2025–2026) using multimodal analytics to measure SRL and teacher dashboard use.
2. **Teacher Agency** – Extending TGSDL to include the teacher's role as a *self-regulated designer* of learning.
3. **Implementation Guidelines** – Developing concrete design principles linking inputs (data, scaffolds) → processes (SRL, SSRL) → outcomes (agency, reflection).
4. **Cross-Cultural Adaptation** – Comparative analysis between Lithuania and Portugal to test TGSDL transferability.
5. **Data Ethics Framework** – Establishing protocols for AI transparency, data control, and learner ownership.

Literary sources

1. Ahola, S., Malmberg, J., & Järvenoja, H. (2024). Investigating upper-secondary learners' contributions in co-regulation and socially shared regulation of learning. *Learning, Culture and Social Interaction, 49*, 100870. https://doi.org/10.1016/j.lcsi.2024.100870
2. Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational behavior and human decision processes*, *50*(2), 248-287.
3. European Commission. (2021). *DigCompEdu: European Framework for the Digital Competence of Educators.* Publications Office of the European Union. https://publications.jrc.ec.europa.eu/repository/handle/JRC107466
4. Hadwin, A. F., Järvelä, S., & Miller, M. (2011). Self-regulated, co-regulated, and socially shared regulation of learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of Self-Regulation of Learning and Performance* (pp. 65–84). Routledge. https://psycnet.apa.org/record/2011-12365-005
5. Khalil, M., Wong, J., & Paas, F. (2024). Adaptive support for self-regulated learning in digital learning environments. *British Journal of Educational Technology, 55*(4), 1281–1289. https://doi.org/10.1111/bjet.13479
6. Kubsch, M., Strauß, S., Grimm, A., & Neumann, K. (2025). Self-regulated learning in the digitally enhanced science classroom: Toward an early warning system. *Educational Psychology Review, 37*(2), 34. https://doi.org/10.1007/s10648-025-10011-9
7. Lämsä, J., de Mooij, S., & Azevedo, R. (2025). Measuring secondary education students' self-regulated learning processes with digital trace data. *Learning and Individual Differences, 118*, 102625. https://doi.org/10.1016/j.lindif.2024.102625
8. Molenaar, I., Azevedo, R., & Järvelä, S. (2023). Measuring self-regulated learning and the role of AI. *Computers in Human Behavior, 139*, 107540. https://doi.org/10.1016/j.chb.2022.107540
9. O'Connell, M. T., Stöhr, C., Wallin, P., & Negretti, R. (2023). *Social regulation of learning in interdisciplinary groupwork. European Journal of Engineering Education.* Advance online publication. https://doi.org/10.1080/03043797.2023.2292258
10. Panadero, E. (2017). A review of self-regulated learning models: Six models and four directions for research. *Frontiers in Psychology, 8*, 422. https://doi.org/10.3389/fpsyg.2017.00422
11. Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning. *Educational Psychology Review, 16*(4), 385–407. https://link.springer.com/article/10.1007/s10648-004-0006-x
12. UNESCO. (2022). *Reimagining our futures together: A new social contract for education.* UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000379707.locale=en
13. Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Metacognition in Educational Theory and Practice* (pp. 277–304). Routledge. https://www.researchgate.net/profile/Allyson-Hadwin/publication/247664651_Studying_as_Self-Regulated_Learning/links/663d16347091b94e930f18f1/Studying-as-Self-Regulated-Learning.pdf
14. Zabolotna, K., Malmberg, J., & Järvenoja, H. (2023). Knowledge construction and group-level regulation in a CSCL physics task. *Computers in Human Behavior, 138*, 107494. https://doi.org/10.1016/j.chb.2022.107494
15. Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal, 45*(1), 166–183.https://www.researchgate.net/publication/250184865_Investigating_Self-Regulation_and_Motivation_Historical_Background_Methodological_Developments_and_Future_Prospects

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Thank you for your attention

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