Learning with Generative Artificial Intelligence Within a Network of Co-Regulation

Jason M. Lodge
The University of Queensland, Australia, jason.lodge@uq.edu.au

Paula de Barba
Monash University, Australia, paula.debarba@monash.edu

Jaclyn Broadbent
Deakin University, Australia, jaclyn.broadbent@deakin.edu.au

Learning with Generative Artificial Intelligence Within a Network of Co-Regulation

Abstract

The emergence of generative artificial intelligence (AI) has created legitimate concerns surrounding academic integrity and the ease with which such technologies might lead to cheating in assessment, in particular. However, fixating solely on potential misconduct is overshadowing a more profound, transformative interaction between learners and machines. This commentary article delves into the relationship between students and AI, aiming to highlight the need for revised pedagogical strategies in the AI age. We argue that the much-discussed approaches that prioritise AI literacy or augmented critical thinking might be inadequate. Instead, we contend that a more holistic approach emphasising self-regulated learning (SRL) and co-regulation of learning is needed. SRL promotes autonomy, adaptability, and a deeper understanding, qualities indispensable for navigating the intricacies of AI-enhanced learning environments. Furthermore, we introduce the notion of a network of co-regulation, which underscores the intertwined learning processes between humans and machines. By positioning the self at the core of this network, we emphasise the indispensable role of individual agency in steering productive human-AI educational interactions. Our contention is that by fostering SRL and understanding co-regulated dynamics, educators can better equip learners for an interconnected AI-driven world.

Practitioner Notes

1. While concerns about AI's potential for cheating are valid, exploring its transformative potential in enhancing learning experiences is vital.
2. Self-regulated learning (SRL) is becoming increasingly crucial. SRL equips students to navigate the complexities of AI-enhanced environments effectively.
3. While AI literacy and an emphasis on critical thinking are important, they may not be enough. A more holistic approach to learning with AI is needed.
4. Educators should focus on ensuring students not only use AI but also understand, adapt to, and learn collaboratively with it.
5. Students are increasingly navigating a complex network, including generative AI that helps them regulate their learning.

Keywords

Introduction

Knowing how to work with increasingly capable machines requires having a deep understanding of our own capabilities and limitations.

There has been much ado about the apparent sudden emergence of generative artificial intelligence (AI or GenAI) with the release of ChatGPT in November 2022. An immediate concern emerged about the possibility of these new tools as a vehicle for cheating across education settings (Lodge et al., 2023b). The threat to academic integrity posed by these technologies is real and continues to create challenges (Hsiao et al., 2023). There has been a substantial global effort to rethink the role of assessment in education (e.g., Swiecki et al., 2022). Much of this effort has understandably been focused on securing assessment to provide some certainty that students receiving a credential have done the work required. However, as identified by Lodge et al. (2023a), a key component of adapting education to the situation caused by the emergence of generative AI is thoughtfully integrating these new technologies into student learning activities. Adapting educational practices, including assessment is as much about working with generative AI as ensuring that students can or are working without it. It has become apparent that generative AI affords a wide range of possibilities beyond the simple production of artefacts that can be submitted to be assessed (Sharples, 2023).

The focus of this commentary is to progress the conversation about the role of generative AI in higher education beyond the issues of academic integrity. As Kramm and McKenna (2023) argue, the 'police-catch-punish' approach is an impoverished way of considering how higher education should adapt to generative AI. While issues associated with the inappropriate use of generative AI in assessment remain a critical problem, the possibilities of using these new technologies to cheat need to be seen within the wider context of the relationship between these technologies and humans (Crawford et al., 2023).

There are ongoing debates about whether generative AI represents anything more than an evolution in technology like the introduction of the calculator. It is becoming apparent that the shift in capabilities and possibilities goes far beyond that kind of technology (Lodge, et al., 2023c). The contribution of this commentary, from the perspective of three psychological scientists working on understanding technology in higher education, is to explore the emerging ideas about how generative AI is and could be used to support learning. We start by delving into an area that is seen as a key factor in integrating these new tools into learning, AI literacy.

Artificial Intelligence Literacy

In response to the challenges described above, AI literacy has emerged as a possible factor for ensuring students are adequately prepared for a world where AI is embedded everywhere (Koh & Doroudi, 2023). AI literacy has had several definitions but all centre on an understanding of AI, how to interact with AI, and how AI interfaces with the world (Ng et al., 2023). The concept of AI literacy should not solely relate to proficiency in using AI technologies or an understanding of how they work but extend to a comprehensive understanding of their underpinning mechanisms, ethical considerations, and sociocultural implications. As part of their higher education experience, students need to be not only introduced to the operational aspects of AI but to be helped to develop a nuanced understanding of its capabilities, limitations, and broader impacts (as per Lodge et al., 2023a). Therefore, AI literacy should represent a scaffold that enables students and educators alike to navigate, critique, and constructively engage with AI technologies while being mindful of the moral, ethical, and social dimensions that are entangled with them. However, it is no simple task to incorporate all this into already crowded curricula.

Beyond the challenges of integrating AI literacy into curricula, the contextual application of the term "literacy" in relation to AI in educational settings is awkward. Often, literacy in this context is operationalised as the acquisition of a particular set of skills or knowledge that can be directly applied in interacting with or utilising AI technologies (see Southworth et al., 2023). This prevailing conceptualisation, whilst being practically valid to an extent, might potentially cloud the deeper, more abstract, and critical understandings required to navigate the intricacies and implications of AI. The reduction of AI literacy to a toolkit of skills or a repository of discrete knowledge may inadvertently restrict the breadth and depth of engagement with AI, limiting the potential for cultivating a more profound, self-referent, and ethically informed understanding. It is this kind of deeper understanding that will be required for the maximum benefits of human-AI collaboration to be realised (Lodge et al., 2023c). We stress the importance of the individual's role in this context. Engaging with AI necessitates an awareness of the interplay between the user and the machine. Grasping the capabilities and constraints of each within this partnership is vital.

To navigate these complexities, a shift is required, wherein students and educators examine their own relationship with knowledge, knowing, and learning. The ethical and appropriate use of AI will increasingly require questioning and reconceptualising the relationships between technology, knowledge, and the self. The human-machine relationship that is often conjured as an analogy is that of students using calculators. Generative AI is not at all like a calculator, there is a continuum of possible human-machine relationships that will influence the learning process (see Molenaar, 2022). The synthesis of AI and epistemic understanding requires an ethically robust scaffold, where the use, creation, and evaluation of AI technologies and the relationships we develop with them are perpetually critiqued, questioned, and reflexively engaged with. That means the machines, our minds, and the connections between them are all considered. In this light, higher education must embrace an approach that is concurrently forward-looking in appropriate technological proficiency and inward-looking in ethical and metacognitive reflexivity. Merely adding additional content on AI into the curriculum as a scaffold is inadequate. AI literacy, as it is currently being applied focusing on its technical and practical understanding, is not sufficiently attuned to the ethical, social, and existential dimensions of engaging with AI, either in education or in the world.

Critical Thinking and Self-Regulated Learning

If AI literacy, at least as it is currently being operationalised, is not the answer, then the immediate question turns to what is. Critical thinking has long been heralded as a cornerstone of education (e.g., Ennis, 1962). However, the emergence of generative AI has led to critical thinking being seen as a crucial foundation for most if not all of education (Lodge et al., 2023b). Generative AI produces novel content, which means that individuals need a rigorous approach to assess, evaluate and engage with the veracity, relevance, and implications of the information presented. Critical thinking provides a framework to do so.

A challenge in advocating for the further integration of critical thinking into curricula arises from the wide range of definitions associated with it (e.g., Griggs et al., 1998). There are multiple interpretations and dimensions of critical thinking (Ellerton, 2015), making it difficult to pinpoint which specific components are crucial in adapting practice to the realities of generative AI. Amidst this ambiguity, one component that distinctly separates humans from machines is evaluative judgement (Zaphir & Lodge, 2023). Evaluative judgement refers to the capability to evaluate the quality of one's own and others' work based on certain criteria or standards (Tai et al., 2017). As Panadero and Broadbent (2018) argue, this evaluative judgement is core to the process of self-regulated learning, enabling learners to discern their strengths and areas for improvement, thereby guiding their learning trajectory.

The notion of self-regulated learning (for review, see Panadero, 2017), rooted in the idea of individuals taking charge of their own learning processes, is a clear differentiator between human and machine capabilities. This type of learning is inherently focused on the self – on one's motivations, metacognitive strategies, and responses to feedback from the environment. This ontological aspect of self-regulated learning, centred around human experiences, introspection, and self-awareness, places it firmly outside the current capabilities of machines, emphasising the unique value humans bring to the learning environment even amidst the rise of generative AI. Therefore, rather than critical thinking being the point of focus for an AI-aligned curriculum, we argue that the emphasis should be on self-regulated learning.

How are Students Using Generative AI?

Thus far, we have predominantly discussed what ought to be done and not touched on what is already occurring. Students are, of course, using generative AI (Chan & Hu, 2023). Collectively, we are still in the early stages of comprehending how students are integrating generative AI into their learning practices. However, with the increasing assimilation of technology into our lives, students are exploring and experimenting with a variety of digital tools to augment their learning processes, and generative AI is no exception. The rapid development and availability of tools, coupled with the recency of the availability of generative AI, leaves us with a limited understanding of how these technologies are being utilised and what their implications are for student learning.

Adding to the complexity of studying this phenomenon is the shift in where and how students learn. Learning practices have started to transcend the traditional boundaries of educational institutions. Today, a significant portion of student learning occurs off-campus, leveraging online platforms and tools that often fall outside formal institutional oversight. For example, many online interactions students engage in occur outside of corporate systems and cannot be integrated into

learning analytics. This decentralisation of learning spaces and reliance on digital platforms adds an additional challenge for an in-depth insight into students' engagement with generative AI and other emerging technologies.

From the glimpses we do gather, it is becoming evident that students are not merely utilising generative AI to produce assessment submissions or automate repetitive tasks (Chan & Hu, 2023). Instead, the landscape of AI-assisted learning appears to be vast and varied, encompassing activities ranging from research assistance to idea generation and collaborative projects (e.g., Sharples, 2023). This situation suggests an evolving ecosystem where students navigate their educational journey through a blend of self-regulation, co-regulation, and socially shared regulation (as per, Hadwin et al., 2011). Within this framework, generative AI, alongside other digital technologies, has the potential to play a pivotal role, complementing interactions with peers and teachers. This intricate network underscores the multifaceted nature of student learning, where generative AI acts not as a replacement but as a partner in the educational process (e.g., Lodge et al., 2023b).

A Network of Regulation?

One way to describe the emerging observations is that self-regulated learning and co-regulated learning are unfolding within a more intricate network involving various agents, including peers, teachers, and the emerging presence of generative AI. While self-regulation emphasises an individual's internal strategies and management of their own learning processes (Zimmerman & Schunk, 2011), and co-regulation and socially shared regulation focus on the collaborative dynamics among participants (Bransen et al., 2022), a network of regulation integrates these elements and then some more. Thus, every actor, whether human or AI-driven, reciprocally shapes the evolving learning process. We see some alignment here between these observations and the notion of entangled pedagogy (Fawns, 2022). Entangled pedagogy is a conceptual framework that emphasises the interwoven relationships between learners, educators, and materials within educational settings, suggesting that these elements are deeply interconnected and cannot be understood in isolation from each other. This postdigital (Jandrić et al., 2018) perspective stresses the dynamic interaction and mutual influence between these agents, wherein each one has a potentially active role in shaping the learning process (Fawns, 2022). AI can be considered one of these agents, taking on tasks from information generation to potentially assess student work or guide learning trajectories.

Drawing from actor network theory (ANT), this evolving entangled network can be perceived as a socio-technical construct wherein both human and non-human entities engage in intricate relationships. ANT posits that entities gain their identity and agency from their relations within the network, emphasising that agency is distributed across these networks (Latour, 2005). However, when considering the role of agency, especially in the context of generative AI, we venture into an area of contention. While some argue that technologies, such as AI, merely act based on pre-defined algorithms and thus cannot be attributed genuine agency, others suggest that their adaptive and responsive capabilities might justify some form of limited agency.

This leaves us grappling with profound questions: *Can generative AI, or broader technologies for that matter, truly possess agency? How does this potential agency reshape the interplay and*

entanglement between students and technologies in higher education? There is also a question about the self in self-regulated learning and how this interfaces with the complex, entangled network of regulation that we have described here. A notion of entanglement might suggest that the parts of the network cannot be understood in isolation from one another, but this argument does not diminish the role of each student as an individual who needs to navigate this network and decide how to progress.

As we delve deeper into these questions, the nature of student learning practices with AI remains uncertain. Further exploration of student engagement with generative AI in educational settings is required. Particularly, it will be vital to understand how these entanglements with technologies are evolving relative to the self and to other humans to form a network of regulation. Even with the power of generative AI added to the equation (with agency or not), relationships between humans will continue to be core to high-quality education.

Knowing oneself as a learner

The burgeoning relationship between humans and generative AI in the educational realm has raised a salient consideration: as machines grow more adept at managing complex ideas and contexts, *how far should the emphasis of education transition from knowledge acquisition (knowing) to cultivating a deeper humanistic understanding of existence (being)?* Generative AI, no matter how sophisticated, lacks the intrinsic human experience and emotions, the nuances of societal interactions, cultural context, and the myriad of other factors that define what it means to be a human in the world. While these machines can process and generate vast amounts of data, they do not possess the lived experiences and emotions that are central to the human condition. In this light, emphasising being over knowing (as per Bridle, 2022) could equip learners with insights and perspectives that are uniquely human, offering a counterbalance to the capabilities of AI.

As the integration of generative AI in higher education deepens, the long-term ramifications remain uncertain. *What learning skills will continue to be important in a world increasingly shaped by AI? If learners find themselves entrenched in an intricate, entangled network comprising both machines and humans, where does the self fit into this equation?* Self-regulated learning skills, such as evaluative judgment, allow individuals to assess the quality of their work and that of others, which remains a critical tool in navigating this evolving situation. However, the co-regulation skills – those necessary for collaborative learning within the AI-human network – are not as clearly defined. Recognising and harnessing the strengths of generative AI while also maintaining human-centric learning attributes will be vital. Determining the exact skills and competencies needed to optimally co-regulate with AI systems remains an open-ended question, challenging educators and learners alike to deliberate and experiment in the age of AI. The solution is not simply to introduce AI literacy or more critical thinking.

What do Policy and Practice Need to Focus on?

The ongoing discussion in higher education needs to shift towards the identification of essential epistemic skills for the age of AI. This involves a rethinking of policy-making principles and a reconceptualisation of curricula to focus on skills that interface with emerging technologies,

ensuring they resonate with the unique challenges presented by generative AI and beyond. These are the skills, such as components of critical thinking, that transcend specific subject matters and are applicable across various domains and real-life situations. However, framing the argument merely in terms of enhancing "21st century skills" or a generic version of critical thinking might be an oversimplification. The situation we collectively face demands a nuanced understanding of what these transferable skills entail. Digital or AI literacy or critical thinking are not sufficient. It has become critical to discern which competencies truly empower students to navigate an ever-changing world, contribute meaningfully to diverse fields, and engage effectively with emerging technologies and societal challenges. Which of these skills are transferrable and which need to be cultivated within deep disciplinary culture and context is also unclear. As such, educators and policymakers need to delve deeper into defining, understanding, and cultivating these skills beyond popular catchphrases and blunt policy instruments.

Core to the competencies that will be required is the underlying need for judgment — understanding not just what is known, but discerning the boundaries of our knowledge, recognising what remains unknown, and assessing the credibility and relevance of information sources. These are relative judgements that are founded in a sense of the self. As we find ourselves embedded in an intricate, perhaps even entangled, web comprising humans, machines, and myriad sub-networks, navigating this maze necessitates more than just algorithmic understanding or analytical prowess. It demands an ability to weave seamlessly between a network of technological interfaces and human interactions, self-regulating by making informed decisions based on a blend of empirical data, ethical considerations, and sociocultural contexts and how all these relate to students' place in the world. There is, therefore, an imperative for education systems to foster a holistic skill set, marrying technological fluency with nuanced judgement, contextual awareness and underpinned by self-regulated learning.

Students grapple with a reality increasingly reminiscent of a supercomplex system (as per Barnett, 2000). Such a system is marked by a myriad of components — from technological tools to social networks — each influencing and being influenced in return. We argue that students remain at the core as distinct individuals with unique decision-making capabilities. Their choices and actions are invariably shaped by a multifaceted, interconnected milieu. They cannot adequately navigate this without a clear sense of their place in it and what steps they need to take to move forward. The nodes and the network are both important.

Crafting effective policies and practices for the thoughtful and ethical incorporation of AI, encompassing facets like generative AI, into higher education necessitates a deep reflection on how students traverse the intertwined network of humans, machines, and interconnected systems. The complexity of this dynamic means that a narrow focus on only the social, only the technological, or only the individual components is inadequate. Advancing our understanding across these levels of analysis is not helped by the longstanding divide in educational research between those focused on the individual and those focused on the social. What is needed is a holistic approach that considers the intricate interplay among these elements. To truly shape meaningful and future-forward strategies, we must recognise and address the symbiotic relationships and dependencies that exist beyond our preferred level of analysis. Students can be and are both individuals and part of a complex socio-technical network simultaneously. Their

existence and their learning are not bounded by the ontological and epistemological boxes we create for ourselves and each other as researchers, practitioners, or policymakers.

Conclusion

We appreciate that this commentary perhaps raises more questions than it can answer. The astonishing pace of development in the technical sphere of generative AI is difficult enough to keep pace with, particularly for scholars like us who are not computer scientists and claim no expertise in the technical side of AI. We hope that this commentary might be useful in pointing to the important questions we need to be asking about learning, particularly self-regulated learning with increasingly capable technologies added into the mix. Even if these technologies cannot be defined as having agency, they are increasingly able to simulate that they do. Students are not punching in a formula and getting a response from these tools, as was the case with a calculator, they are engaging in something that increasingly looks more like a conversation or a partnership.

Adapting higher education to the age of generative AI means that we need to ask profound questions about identity, the self, the nature of knowledge and knowing in addition to the relatively mundane questions, such as; *how do we stop students cheating now*? The emergence of generative AI has been discussed *ad nauseam*, there is a lot of hype and a lot of despair. Among all the debate and discussion, one thing is clear; this technology represents a fundamental shift in the relationship between students and technology in their learning. Alongside the new learning practices that students are engaging in, new teaching practices and policies are needed. Adding more content and/or focusing on routine administrative processes to stop cheating are well short of what will be required to adapt.

Conflict of Interest

References

Barnett, R. (2000). University knowledge in an age of supercomplexity. *Higher Education 40*, 409–422. https://doi.org/10.1023/A:1004159513741

Bransen, D., Govaerts, M. J. B., Panadero, E., Sluijsmans, D. M. A., & Driessen, E. (2022). Putting self-regulated learning in context: Integrating self-, co-, and socially shared regulation of learning. *Medical Education, 56* (1), 29-36. https://doi.org/10.1111/medu.14566

Bridle, J. (2022). *Ways of being: Beyond human intelligence*. Allen Lane.

Chan, C. K. Y., & Hu, W. (2023). Students' voices on generative AI: perceptions, benefits, and challenges in higher education. *International Journal of Educational Technology in Higher Education, 20*(1). https://doi.org/10.1186/s41239-023-00411-8

Crawford, J., Cowling, M., & Allen, K. (2023). Leadership is needed for ethical ChatGPT: Character, assessment, and learning using artificial intelligence (AI). *Journal of University Teaching & Learning Practice, 20*(3). https://doi.org/10.53761/1.20.3.02

Ellerton, P. (2015). Metacognition and critical thinking: Some pedagogical imperatives. In M. Davies, & R. Barnett (eds.), *The Palgrave handbook of critical thinking in higher education* (pp. 409–426). Palgrave Macmillan. https://doi.org/10.1057/9781137378057_25

Ennis, R. H. (1962). A Concept of Critical Thinking. *Harvard Educational Review, 32*(1): 81-111.

Fawns, T. (2022). An Entangled Pedagogy: Looking Beyond the Pedagogy—Technology Dichotomy. *Postdigital Science and Education 4*, 711–728. https://doi.org/10.1007/s42438-022-00302-7

Griggs, R. A., Jackson, S. L., Marek, P., & Christopher, A. N. (1998). Critical thinking in introductory psychology texts and supplements. *Teaching of Psychology, 25*, 254–265. https://doi.org/10.1080/00986289809709711.

Hadwin, A. F., Järvelä, S. & Miller, M. (2011). Self-regulated, co-regulated, and socially shared regulation of learning, in B. J. Zimmerman and D. H. Schunk (eds.) *Handbook of Self-Regulation of Learning and Performance*, Routledge.

Hsiao, Y., Klijn, N. & Chiu, M. (2023) Developing a framework to re-design writing assignment assessment for the era of Large Language Models. *Learning: Research and Practice, 9* (2). 148-158. https://doi.org/10.1080/23735082.2023.2257234

Jandrić, P., Knox, J., Besley, T., Ryberg, T., Suoranta, J., & Hayes, S. (2018). Postdigital science and education. *Educational Philosophy and Theory, 50* (10), 893–899. https://doi.org/10.1080/00131857.2018.1454000.

Kramm, N. & McKenna, S. (2023) AI amplifies the tough question: What is higher education *really* for? *Teaching in Higher Education*. https://doi.org/10.1080/13562517.2023.2263839 (online first)

Koh, E. & Doroudi, S. (2023) Learning, teaching, and assessment with generative artificial intelligence: towards a plateau of productivity, *Learning: Research and Practice*, *9* (2), 109-116. https://doi.org/10.1080/23735082.2023.2264086

Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory.* New York: Oxford University Press.

Lodge, J. M., Howard, S., Bearman, M., Dawson, P., & Associates (2023a). *Assessment reform for the age of Artificial Intelligence*. Tertiary Education Quality and Standards Agency.

Lodge, J. M., Thompson, K., & Corrin, L. (2023b). Mapping out a research agenda for generative artificial intelligence in tertiary education. *Australasian Journal of Educational Technology*, *39*(1), 1–8. https://doi.org/10.14742/ajet.8695

Lodge, J. M., Yang, S., Furze, L. & Dawson, P. (2023c) It's not like a calculator, so what is the relationship between learners and generative artificial intelligence?, *Learning: Research and Practice*, *9* (2), 117-124. DOI: 10.1080/23735082.2023.2261106

Molenaar, I. (2022). The concept of hybrid human-AI regulation: Exemplifying how to support young learners' self-regulated learning. *Computers and Education: Artificial Intelligence*, *3*, 100070. https://doi.org/10.1016/j.caeai.2022.100070

Ng, D. T. K., Lee, M., Tan, R. J. Y., Hu, X., Downie, J. S., & Chu, S. K. W. (2023). A review of AI teaching and learning from 2000 to 2020. Education and Information Technologies, 28(7), 8445-8501. https://doi.org/10.1007/s10639-022-11491-w

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology, 8*. https://doi.org/10.3389/fpsyg.2017.00422

Panadero, E., & Broadbent, J. (2018). Developing evaluative judgement: A self-regulated learning perspective. In D. Boud, R. Ajjawi, P. Dawson, & J. Tai (Eds.), *Developing evaluative judgement: Assessment for knowing and producing quality work*. Abingdon: Routledge.

Sharples, M. (2023). Towards social generative AI for education: Theory, practices and ethics. *Learning: Research and Practice, 9* (2), 159-167. https://doi.org/10.1080/23735082.2023.2261131

Southworth, J., Migliaccio, K., Glover, J., Reed, D., McCarty, C., Brendemuhl, J., & Thomas, A. (2023). Developing a model for AI across the curriculum: Transforming the higher education landscape via innovation in AI literacy. *Computers & Education: Artificial Intelligence, 4*, Article 100127. https://doi.org/10.1016/j.caeai.2023.100127

Swiecki, Z., Khosravi, H., Chen, G., Martinez-Maldonado, R., Lodge, J. M., Milligan, S., Selwyn, N., & Gašević, D. (2022). Assessment in the age of artificial intelligence. *Computers and Education Artificial Intelligence, 3*, 100075. https://doi.org/10.1016/j. caeai.2022.100075

Tai, J., Ajjawi, R., Boud, D., Dawson, P., & Panadero, E. (2017). Developing evaluative judgement: Enabling students to make decisions about the quality of work. *Higher Education, 76,* 457-481. https://doi.org/10.1007/s10734-017-0220-3

Zaphir, L. & Lodge, J. M. (2023, June). Is critical thinking the answer to generative AI? *THE Campus, Times Higher Education*. https://www.timeshighereducation.com/campus/critical-thinking-answer-generative-ai

Zimmerman, B. J., & Schunk, D. H. (2011). Self-regulated learning and performance. An introduction and an overview. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance.* Routledge.