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Commentary

Looking down the road: Future directions for research on depth and regulation of strategic processing

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Purpose. The primary goal of this commentary was to consider the future directions that researchers dealing with levels and regulation of strategies and with approaches to learning may wish to pursue in the years to come.

Procedure. In order to accomplish this goal, the first step was to look for any common ground shared by authors contributing to this Special Issue. That common ground represented a convergence of evidence for these programmes of research; in effect, where they intersect. Next, theoretical, methodological, and data-analytic barriers that have long impeded progress within and across these research communities were identified.

Outcome. Recommendations were offered that might serve to diminish or remove those existing barriers and, thus, open new avenues of inquiry.

It is a privilege to serve as a commentator for this Special Issue that examines the complicated relation between depth and regulation of strategic processing, especially in the light of the international scholars chosen as contributors. According to the editors, the purpose of this issue is to consider how levels of cognitive strategy use among students relate to their metacognitive or self-regulatory behaviours (Dinsmore & Fryer, 2018). Contributors to the issue were to be guided by three overarching questions:

1. What is the association between cognitive and metacognitive processing during academic performance in varied contexts (e.g., text, technology rich environments, university settings)?
2. How does the shifting developmental landscape change associations between depth of processing and monitoring and regulation of learning on academic performance?
3. Do individuals' competence help explain associations between monitoring, regulation, and strategic processing? (p. 2)

To the credit of the editors, these are timely, important, and ambitious questions to be posed at this juncture when theory and research into strategic processing approach the half-century mark. Any issue that effectively addresses any one of these complex questions

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will have made a significant contribution to the extant literature and set a course for improved enhanced student learning and instructional practice. Moreover, in conceptualizing this issue, Dinsmore and Fryer not only sought international scholars with expertise in this field, but also individuals representing varied theoretical and methodological traditions. That diversity is more than evident in this collection of articles. For one, there are three overarching theoretical models referenced in the various articles, Approaches to Learning (ILS, Vermunt, 1994), the Model of Domain Learning (MDL, Alexander, 1997, 2003), and Self-Regulated Learning (SRL, Winne, 2010; Zimmerman & Schunk, 2011). Further, as the editors promised, there are different populations, academic domains, learning contexts, experimental measures, and statistical techniques represented.

In preparing my responses to this intriguing collection, I was taken by the editors' choice of the word *intersection* in the title to situate the relation between levels and regulation of strategies, as well as approaches to learning. That word evoked an image of distinct avenues of theory and research temporarily crossing paths and then continuing on their separate ways. Whether this was the editors' intention, I cannot say. Nonetheless, this metaphorical allusion became the stimulus for my response. My primary goal in this commentary was to look down the road to the next decade of theory and research on learners' strategic processing and approaches to learning and to forward recommendations to those who are likely to pave the path that others will follow. Yet, to accomplish this goal, there are initial steps that must be taken.

First, it is necessary for me to find evidence of intersection among these contributing authors who represent diverse perspectives and traditions regarding the depth and regulation of strategies and approaches to learning. By identifying these points of convergence, I will be better positioned to envision future directions. Second, I want to pinpoint the obstacles researchers have encountered on their journey towards greater understanding of the cognitive and metacognitive behaviours that learners manifest or the orientation towards learning they espouse. Some of those obstacles are apparent to anyone engaged in this research, whereas others are more embedded and, thus, harder to see and to avoid. Further, in certain cases, barriers to progress arise more often for one research tradition, one learner population, or one academic domain than for another. In other cases, these obstructions are common to all pursuing the goal of enhanced learning and academic development. However, they manifest or for whom, the drive to remove these obstacles will set a future course for these avenues of inquiry.

Convergence of evidence

Several years ago, I was negotiating the meaning of learning with Diane Schallert and Ralph Reynolds (2009), who represent contrasting theoretical perspectives on this complex construct. It was then that I became reacquainted with writings of Wilson (1998) around consilience. Drawing on philosophical work of Whewell (1840), credited with coining the term *consilience*, Wilson (1998) argued that researchers should search for the unity of knowledge that emerges from the diverse perspectives or distinct methodologies associated with an important issue or construct. That unity of knowledge, in effect, represents a convergence of evidence; the empirical bedrock upon which inquiry should be based. I have subsequently employed this analytic technique on recent occasions when trying to extract the essence of complex and controversial constructs, including relevance (Alexander, 2018) and reflectivity (Alexander, 2017). Thus, when preparing my response to this Special Issue, I returned to consilience once more. I sought the common ground

shared by these scholars under the expectation that this area of convergence of evidence best captured what is known about depth and regulation of strategies and approaches to learning.

As I quickly came to realize, there are indeed points of convergence among those who investigate strategies and those concerned with approaches to learning. Specifically, the common ground shared by the contributing authors to this Special Issue is as follows:

> There are discernible, non-random patterns in the way individuals and groups strategically engage in learning.

Before the 20th century dawned, the pragmatist William James (1890) articulated significant principles about human learning and development that remain relevant today. One of those principles related to humans' tendency to habituate their thinking and behaviours. To put it simply, humans are notorious creatures of habits. Regardless of age or background, individuals quickly establish routines that allow them to function efficiently and effectively in the world. This habituation manifests in the cognitive domain as much as in the physical or social realm.

Whether the contributors to this Special Issue are exploring cognitive or metacognitive/regulatory strategy use or approaches to learning, they apparently have taken as a given that there are, in fact, reliable, predictable patterns (i.e., habits) in the way humans operate in academic contexts. Moreover, these authors seemingly ascribe to the premise that, with the right measures and techniques, they can uncover those habits of thought and behaviour, quantify and analyse the results, and draw conclusions of educational importance. If these contributing authors did not believe that there are discernible, non-random patterns in the way individuals and groups strategically engage in learning, there would be no reason to conduct the investigations represented in this Special Issue.

> Individuals are able to describe their strategic behaviours or general approaches to learning with some consistency.

When it comes to discerning those habits of mind and behaviour to which I just referred, there is yet another commonality that emerges across the articles in this Special Issue. Specifically, contributing authors apparently accept the idea that the participants in their studies, regardless of their ages, sociocultural backgrounds, or academic experiences, have an awareness of and an ability to articulate the procedures they are using, have used, or typically use when engaged academically. In effect, these researchers operate under the assumption that what is revealed during think-alouds, post-performance interviews, or questionnaires has sufficient correspondence to what actually transpires to merit analysis.

For instance, framing their study within self-regulated learning or SRL, Deekens, Greene, and Lobczowski (2018) re-analysed think-aloud data from two investigations as the means to establish a statistical, if not a theoretical, relation between depth of processing and frequency of monitoring and, ultimately, high-school and college students' performance on history and science tasks. Operating from a different framework, Catrysse *et al.* (2018) used first-year psychology students' responses on the Inventory of Learning Patterns-Short Version (Donche & Van Petegem, 2008) to craft learner profiles. Eye-tracking data were then gathered from a subgroup of the different profiles with the goal of linking profiles to regulatory behaviour. Clearly, for both of these investigations, the

researchers regarded what participants voiced or wrote as credible evidence of what was occurring inside their minds or what they routinely do when learning.

Individual factors and task or contextual features influence learners' behaviours.

Another principle James (1890) articulated, which may at first blush seem paradoxical with the notion of habitation, pertained to the uniqueness of human experience. Echoing the pre-Socratic philosopher Heraclitus, who famously said that 'No man ever steps in the same river twice, for it's not the same river and he's not the same man', James contended that the continuous flow of events humans experience ensure that no thought or action can ever be truly replicated. Rather, those thoughts or actions iterate. That is to say, thoughts and actions can repeat in an approximate way, being inevitably shaped by the changing conditions within individuals or external to them. The resulting pattern is still recognizable as a variant of what has occurred; just not an exact copy.

Certainly, this same principle applies to students' strategic behaviour or approaches to learning. All learners may adopt certain processing rituals or routines, but those rituals and routines are expected to iterate as conditions internal or external to the learner shift. In fact, there are a various internal and external influences mentioned by the contributing authors, such as learner characteristics (e.g., topic knowledge or domain interest), specific task features (e.g., complexity or structuredness of the task), and performance venue (e.g., on computer or in history or science classrooms). Thus, converging evidence supporting this claim manifests throughout this Special Issue.

For example, Fryer and Vermunt (2018) used Latent Profile Transition Analysis to examine the profiles of Japanese students at the beginning and end of their first year at college. Data for this analysis came from select scales measuring deep and surface approaches to learning and three modes of regulation (i.e., self, external, and lack of). Relevant to the claim of strategic iteration, Fryer and Vermunt determined that four profiles captured the data effectively at the beginning of the school year – Low Quality, Low Quantity, Average, and High Quantity. By the end of the school year, while the membership of the Average and Low Quality profiles remained quite stable, there was a noticeable shift in membership for students initially populating the High and Low Quantity profiles.

The authors had not anticipated this pattern in 'movers' and 'stayers' and explored a number of possible explanations for their findings. One of those explanations was internal to the students and centred on the possible adequacy of the Average groups approaches to learning and regulatory behaviours for the academic context. Another, which was more external in form, posited that the movers from High Quantity to Low Quality or Average groups may reflect 'friction between their strategy use and the expectations of the environment' (p. 36). The prevailing cultural within Japanese higher education was also discussed as an external force that may have exerted influence on these students' approaches to learning and regulatory behaviours.

Investigating strategies through the lens of the MDL (Alexander, 1997, 2003), Parkinson and Dinsmore (2018) considered the influence of readers' domain-specific knowledge and interest on their text processing. Their findings revealed how quality more than quantity of high-school students' strategy use was at issue. Further, certain students relied more on their knowledge base than others, and it mattered whether the text they read was expository or persuasive in form.

Scheiter, Schubert, and Schüler, 2018 also focused on the role of knowledge in strategic processing. These researchers wanted to determine whether a substantial

amount of domain knowledge would override university students' use of a particular technique shown to be effective with elementary students' reading of multimedia texts. The Eye Movement Modeling Examples (EMME) technique they implemented involves showing participants videos of the eye gaze patterns of skilled learners studying texts containing pictures or graphs as a visual model. As they hypothesized, these authors found that those with a substantial base of content knowledge did not follow the recommended eye-tracking pattern when integrating text and visual media.

> There is a positive association between depth and frequency of strategy use, on the one hand, and regulatory behaviours and academic outcomes on the other.

Perhaps the most salient point of convergence for the authors in this Special Issue is the reasonable presumption that it is desirable for students of all ages and backgrounds to manifest those thoughts and behaviours indicative of deeper processing with regularity, regardless of the task or domain with which they are engaged. Moreover, there is the acknowledgement that such depth of processing is intertwined with the regulation or monitoring of performance and tied to better learning or task outcomes.

Dinsmore and Zoellner (2018) tackled this very idea directly in their investigation of the interplay between deeper or more surface-level cognitive strategies and metacognitive strategies and college students' performance in a science simulation task. What their analyses revealed was that considering only the depth and frequency of cognitive strategies did not adequately explain the outcomes. Ultimately, what they determined through smallest space analysis was that students' outcomes on a climate simulation task was best captured by cognitive *and* metacognitive dimensions of functioning and certain clusters of strategies that manifest within that multidimensional space.

Similarly, Deekens *et al.* (2018) used think-aloud data from high-school and college students to explore the relations between the depth and frequency of cognitive strategy use and the frequency of regulatory behaviour. Echoing Dinsmore and Zoellner (2018), Deekens *et al.* concluded that focusing only on depth or frequency of strategy use was insufficient to represent the nature of effective learning in those studies. This association between the cognitive and metacognitive dimensions of learning and academic performance that Deekens *et al.* and Dinsmore and Zoellner empirically investigated is theoretically addressed by Winne (2018). Specifically, Winne draws on his decades of research on SRL to illustrate how depth and levels of strategic processing play out across the phases of his model of self-regulated learning. He also deconstructs the notion of depth of processing as it is frequently used in the literature – an issue I will revisit in this commentary.

Additional insights

Beyond these key principles shared by the contributors, I want to briefly touch upon additional insights I was able to extract from the collective works comprising this Special Issue. I offer these here as important reminders of what are currently held as 'truths' about the process of learning. Simply stated, I would summarize those insights as follows:

> Learning is ultimately a complex, multifaceted, and dynamic process that cannot be fully represented by any one theoretical framework, set of beliefs, or cluster of processes.

The more that educational psychologists or learning scientist come to understand of the process of learning or about learners, the more they appreciate that they will never be able to capture the nature of this fundamental human activity in its entirety. At best, they can attempt to richly and accurately describe certain dimensions or mechanisms of that process in such a way as to enlighten students, teachers, educational leaders, and policymakers. Certainly, ILS, the MDL, and SRL are theoretical frameworks that highlight important facets of learning and academic development, but they are by no means all-encompassing. This fact was made apparent in each article by the constraints, challenges, and limitations the authors dutifully acknowledged.

> There are diverse ways to unearth and examine what learners 'do' or 'think they are doing'.

When Wilson (1998) forwarded the concept of consilience, he argued that it was surely possible that researchers using very diverse methodologies and approaching a problem from different theoretical frameworks can arrive at similar conclusions. That was certainly the case for the articles populating this Special Issue. Whether these scholars relied on data from think-alouds, questionnaires, simulation programmes, retrospective interviews; gathered real-time physiobiological indicators or regulatory trace data; or used variable-centred or person-centred analyses, their findings intersect to some degree.

> There are relevant distinctions to be made among the processes involved in learning and academic performance.

Throughout this Special Issue, contributors found it empirically necessary to identify different forms or levels of learning processes. Thus, readers will encounter references to processes that are deep versus surface or shallow; cognitive versus metacognitive versus regulatory; routine versus intentional; and general versus domain-specific. This litany of terms is significant in that it conveys that effective learning and academic performance entail layers or categories of procedures that differ in theoretically and practically important ways that demand empirical consideration. Thus, it matters whether the learner is executing a particular mental procedure in task performance (cognitive) or monitoring whether that procedure is functioning effectively (metacognitive or self-regulatory). It matters whether students are enacting procedures that allow them to make sense of a problem or task (surface) or to critically analyse its form or content (deep).

> Effective learning and academic performance require the orchestration of skills and strategies at varying levels or in different categories.

While it is crucial to acknowledge procedural distinctions that manifest in learning and academic performance, it is equally important to appreciate that it is the orchestration of these procedures that ultimately leads to effective outcomes (Dinsmore & Alexander, 2012). For instance, it would be easy to construe that deep strategies are somehow superior to surface strategies or that cognitive and metacognitive processes function separately. Yet, all learners at all levels of expertise employ both surface and deep strategies according to the MDL (Alexander, 1997, 2003), and there is a continual interplay between cognitive and metacognitive processes as the models and research in self-regulated learning establish (Hadwin & Winne, 2001; Winne, 1982).

Lingering concerns

I would not be performing my role as commentator for this Special Issue well if I simply identified the shared principles and important insights that the authors of these articles have contributed to the knowledge base on levels and regulation of strategies and approaches to learning. I must also look critically at these intersecting literatures and what remains as barriers to achieving even greater understanding of learning and academic performance. These barriers are not confined to any one theoretical framework or programme of research. Rather, these conundrums impede progress for all researchers on this journey to understand human learning and academic development, and they have done so for decades.

A muddled distinction between strategic and skilful behaviour

Strategies are the centrepiece for this Special Issue and a key component in the theoretical frameworks referenced (e.g., ILS, MDL, and SRL). Further, strategic processing is a concept that is often discussed within the instructional literature as essential for normally developing and identified populations (Graham, Harris, & Mason, 2005; Pressley & Harris, 2008) across grades and academic domains. Yet, what exactly counts as a strategy and what does not remain problematic? That is why there are those who have sought to differentiate these procedures from skills (Afflerbach, Pearson, & Paris, 2008; Alexander, Grossnickle Peterson, Dumas, & Hattan, in press).

For example, in our perspective on strategy research, Karen Harris, Steve Graham, and I (1998) claimed that strategies have six specific attributes. 'Specifically, strategies can be understood as *procedural*, *purposeful*, *effortful*, *willful*, *essential*, and *facilitative*' (p. 130). This characterization was used to delineate the parameters between strategies and skills.

> Although there are indeed certain characteristics that strategies and skills share (e.g., they both forms of procedural knowledge), there are at least two significant differences. These differences pertain to the automaticity of performance and to learner awareness or intentionality. . . .In effect, skills are procedures that have been routinized. That is, students hone these techniques to a level of automaticity, enabling them to perform a given task fluidly and effectively. Skills are the 'habits' of performance, or what a learner typically does (James, 1890). (p. 135)

Others have similarly differentiated between strategies and skills (Afflerbach *et al.*, 2008; Paris, Lipson, & Wixson, 1983) and have also bemoaned the confounding of these terms within the educational literature. Such problems may arise from researchers' failure to explicitly define these terms or treat them as synonyms. I encountered these problems within the articles comprising this Special Issue. Thus, it would appear that the confounding of strategic and skilful processing remains a barrier for those investigating the levels and regulation of strategies, and approaches to learning, albeit it for different reasons.

For instance, in the case of research into ILS, where individuals attempt to accurately represent the typical way they engage academically, there is no mechanism to ascertain whether respondents are describing automated routines or more intentional actions. Perhaps that is why Fryer and Vermunt (2018) wisely chose McKeachie, Pintrich, and Lin's (1985, p. 154) purposely broad definition of learning strategies as 'cognitions or

behaviours that influence the encoding process and facilitate acquisition and retrieval of new knowledge' to guide their work.

Interestingly, McKeachie *et al.* chose this definition precisely to sidestep the complications of trying to adhere to the theoretical distinctions between strategies and skills in instructional practice. Within the MDL, the clarity that exists theoretically between strategies and skill is likewise problematized when it comes to discerning what is routine versus intentional enactment in actual performance. The empirical tools that are available simply do not allow for that critical determination in most cases. Thus, beyond placing a learner in a novel situation, like the climate simulation used by Dinsmore and Zoellner (2018), there is little assurance that what one is witnessing is either a well-honed routine or a purposeful and effortful response to a specific problem.

Different specifications as to what counts as surface or deep strategies

It is not only the problem of distinguishing between strategies and skills that hampers progress in the study of learning and academic performance, but also the issue of reliably identifying surface versus deep processes. As I read the articles in this issue, what I found were similar designations applied to different procedures. What constituted a surface-level strategy in one study was considered a deep strategy in another.

The article by Parkinson and Dinsmore (2018) draws directly from the MDL in the manner in which surface-level and deep strategies are defined and identified in their study of high-school students' reading of expository or persuasive texts. Specifically, Parkinson and Dinsmore defined surface-level strategies as processes aimed at making sense of the problem, such as underlining or rereading text. Deep strategies, by comparison, were defined as those used to integrate or transform – and I would add evaluate – the text or the content being conveyed by the text.

In a somewhat related vein, Fryer and Vermunt (2018) discussed surface and deep approaches to learning more in terms of learners' goals or aims than in relation to procedures they are using to accomplish a task. Thus, surface approaches focus on remembering what is required for a task and deep approaches are more about achieving understanding. From the sample items they provide for surface (e.g., I concentrate on learning just those bits of information I have to know to pass.) and deep approaches (e.g., I often find myself thinking about ideas from my course when I'm doing other things.), I saw some correspondence to performance and mastery goals in the achievement motivation literature (Midgley, Kaplan, & Middleton, 2001).

To these two views on level or depth of processing, Winne (2018) offers yet another that reflects the perceived difficulty of instructional objectives for a given task. This view is perhaps best exemplified by the taxonomy of educational objectives in the cognitive domain first articulated by Bloom, Engelhart, Furst, Hill, and Krathwohl (1956) and subsequently updated by Anderson *et al.* (2001). Broadly speaking, what this conceptualization does is assign a level of cognitive demand to the processing specified as an instructional aim. So, the 'comprehension' (understanding) level is held as deeper than the 'knowledge' (memorization) level, but less cognitively demanding than the goal of synthesizing. This discussion also points out that confusion remains about notions of level and depth that interfere with continued progress.

Overreliance on self-report measures and spotty connections to academic outcomes

Two other barriers that have long impeded research into levels and regulation of strategic processing and approaches to learning pertain to data sources and outcome measures. For one, those engaged in this research too often must rely solely on the recollections, reflections, explanations, and interpretations of participants. The limitations of self-report data, whether gathered through think-alouds, interviews, questionnaires, or focus reports, have been well documented (Tourangeau, 2000; White, 1988). Although there are steps that can be taken to increase their reliability (Ericsson & Simon, 1998), the total reliance on self-report data remains problematic.

For another, when researchers, like those contributing to this Special Issue, are ultimately concerned with the facilitation of students' learning and academic development, it is reasonable to expect that the studies they conduct include academic outcomes. Further, those outcome measures should relate to valued conceptual and procedural content, and the design of studies should allow for more causal rather than correlational judgements. In essence, if students' levels and regulation of strategies or their espoused approaches to learning do not lead to improved learning or academic performance, then why should they ultimately matter to those expected to enact or manifest them?

Thankfully, for the contributors to this Special Issue, indicators of learning appear integral to their research designs – from solving climate simulation problems and answering questions about expository and persuasive text to performance on tests on cell division or the circulatory system. Regrettably, this characteristic is not commonplace in the literature. Thus, until researchers routinely show evidence of learning and performance effects, this unnecessary obstruction will remain.

More attention to the role of learner characteristics

As discussed, it is widely accepted that internal factors play a significant role in strategic and regulatory behaviours and approaches to learning. For instance, in this Special Issue, this is evident in terms of the role of topic or domain knowledge in the depth and frequency of strategy use (Parkinson & Dinsmore, 2018; Scheiter, *et al.*, 2018). In the light of this fact, it is surprising how often those undertaking research on cognitive or regulatory behaviours or approaches to learning fail to systematically gather data on participants and use those data in their analyses. Minimally, prior knowledge measures should be routinely gathered, along with indicators of task/domain familiarity or motivations.

Moreover, beyond data on students' knowledge of or motivations towards the task, topic, or domain, it may be pertinent to measure such executive functions as working memory or relational reasoning that could significantly influence performance on certain cognitive tasks. For example, such executive functions may well have contributed to participants' performance on the climate simulation task in the Dinsmore and Zoellner (2018) study or the strategic processing of the high-school students in Parkinson and Dinsmore (2018) investigation, over and above knowledge and interest.

Consequently, the more that researchers know about the participants in their studies, the better positioned they are to interpret their outcomes. This was very clearly illustrated in the conclusions that Scheiter *et al.* (2018) reached when their EMME intervention did not have the predicted effects on learning outcomes. As they reported, 'weaker students showed even poorer recall of the information after having watched EMME, whereas recall performance of stronger students was unaffected by the experimental manipulation' (p. 91). If these researchers had not wisely measured students' general scientific literacy

and their knowledge of cell division, the absence of a learning effect would have remained a puzzlement.

A good deal of other- or coregulation within the self-regulation literature

Although I have directed many of my comments to research on levels of strategic processing and approaches to learning, there is one barrier that is particular to the literature on SRL. This concern, which others have recognized (Dinsmore, Alexander, & Loughlin, 2008; Winters & Alexander, 2011; Winters, Greene, & Costich, 2008), represents a conceptual and operational confound. Specifically, in much of the research that purports to explore the relation of self-regulation to learning and academic performance, there are explicit questions or prompts requiring monitoring or regulation posed by a researcher, teacher, or peer. Such scaffolds have also been incorporated in computer-based learning environments or CBLEs (Azevedo, Cromley, Winters, Moos, & Greene, 2005).

For example, in the Azevedo *et al.* (2005) study, Microsoft Encarta materials on the circulatory system, like those used by Deekens *et al.* (2018), were modified to test the effects of three kinds of scaffolds embedded in the CBLE. What is relevant to this commentary is that these researchers discussed their procedures and outcomes in terms of *self*-regulation, despite the fact that their participants displayed no self-initiated regulation. Thus, if researchers are going to want to investigate the role of regulatory processes in learning and academic performance, then they need to be more precise in the forms of regulation operating in those environments (e.g., self, other, peer).

Future directions

I would like to bring this commentary to a close by humbly suggesting viable ways to address the barriers just described. I do so because I think that decreasing or removing these obstacles that have long been impediments will not only facilitate progress along the paths already established, but may also open new avenues of inquiry. Moreover, I expressly direct my suggestions to the Special Issue contributors and others actively engaged in research pertaining to strategies and approaches to learning, because I strongly feel that these scholars possess the expertise and experience required to undertake the innovations needed to enact these recommendations. In addition, those who identify with such frameworks as the MDL, ILS, and SRL can pave the way on some of the ontological and methodological issues entailed in these recommendations, then it is more likely that others within their communities of practice will follow.

More clearly establish the conceptual boundaries between skilful and strategic performance and seek out or devise measures and procedures that align with the resulting conceptualizations.

Just the act of explicating the constructs that guide this research and achieving some degree of consensus as to their meaning will be a major advancement for studies that involve cognitive and metacognitive or regulatory strategies. This would especially be the case if individuals consistently referenced these terms in the design and reporting of their research. Moreover, understanding how routinized versus intentional procedures situate within the work on approaches to learning, which focuses on general orientations more than specific processes, should also prove enlightening.

Of course, defining and using terms conceptually is one thing. Employing or creating experimental tools and procedures that work in concert with those conceptual definitions is another. There is unquestionably a need for those with the knowledge and creativity to devise alternative techniques and tasks, develop novel measures, and construct new learning environments that permit researchers to disentangle typical from adaptive responses to academic tasks. For example, were researchers able to establish an individual's procedural baseline for a familiar and easy reading task and then track that individual's processing for a reading task that was novel or appreciably more difficult, they would have an inkling of how that individual performs both skilfully and strategically. Certainly, there must be creative ways yet to be discovered that would allow for the distinctions between skills and strategies that are theoretically significant to be accurately identified in practice.

> Aim for greater consensus as to what the various levels or classes of strategies signify and focus on those differences in subsequent studies.

Just as I am calling for greater consistency in the use of the designations *strategy* and *skill*, I am recommending that those who engage in research where the levels or depth of strategic process are relevant to find common ground as to what the notion of depth means and what actions might typically fall at various levels. Although I can appreciate the argument that Winne (2018) forwards regarding the multiple ways in which depth can be calculated (i.e., the aim of the process, the perceived difficulty of the cognitive target, or the demands of the task), I do consider that multiplicity as bypassing the necessity for consistency. If anything, the added complexity Winne outlines heightens the need to consider the typography of 'depth' carefully and label its multiple dimensions accordingly.

Beyond the issues of levels, there are other categorical labels appearing in this Special Issue that might also benefit from definitional scrutiny. For instance, it would seem that the literature has already tackled the cognitive versus metacognitive and regulatory designations (Dinsmore & Alexander, 2012; Dinsmore *et al*., 2008; Garner, 1987). In addition, contributing authors seemed comfortable with these distinctions. Of course, the relation between metacognition and self-regulation and between self-regulation and self-regulated learning, which have been cause for concern in the past, may still demand attention and oversight from those best positioned to understand whatever the subtleties of those relations.

> Base findings on more than self-report data and include measures of learning and academic performance whenever possible.

Perhaps one of the clearest recommendations I would forward to this research community is to strive to incorporate data that are not solely reliant on the recollections, reflections, explanations, and interpretations of study participants. I do not mean to suggest that well-established questionnaires or measures, like the ILS, or often employed techniques, like think-alouds, are problematic. To the contrary, these are valuable tools for those engaged in research on levels and regulation of strategies and approaches to learning. Rather, what I am recommending is that these tools should be combined with other more objective measures.

Additionally, as researchers consider the various measures they will make central to their studies, I strongly recommend that relevant learning and achievement outcomes

routinely be included. What aspects of learning and academic performance are measured and the specific form those outcomes take is not at issue, provided that they are well matched to the study goals and are psychometrically sound. Thus, these outcomes can be domain-general or domain-specific, commercially produced or researcher developed, and focused on immediate and direct effects or delayed and transfer effects.

> Build rich profiles on study participants that can be potentially applied in person-centred analyses or in the interpretation of variable-centred analyses.

It is a truism to say that learners are an essential component in any study of learning and academic performance. Yet, as just discussed, researchers often provide limited data on their participants even though those data could be pivotal to the questions they investigate. In the future, therefore, I am strongly recommending that researchers carefully weigh what characteristics of the individuals should be part of the design calculus. When it comes to questions of learning and academic development, knowledge of the domain or topic, relevant experiences, learner goals and interests, domain-specific abilities, general cognitive capacity, working memory, and relational reasoning are among the data points that merit consideration. Along with commonly gathered information on age, gender, and ethnicity, such individual difference factors would allow researchers to better interpret the patterns within their data in variable-centred analysis (Parkinson & Dinsmore, 2018; Scheiter *et al.*, 2018). Moreover, rich data on learners could be applied in person-centred analyses, including cluster analysis and latent profile analysis (Fryer & Vermunt, 2018).

> Investigate the internalization of regulatory prompts, cues, and scaffolds.

Self-regulation is unquestionably a foundational process in learning and academic performance, and the empirical literature on self-regulated learning is clearly substantial and informative. Within that literature, there are those who have tackled the question of the development of self-regulation (Demetriou, 2000; Pressley, 1995). What these scholars consider are questions of when in the course of a students' academic life (e.g., age or grade level) and under what conditions (e.g., knowledge base, prior experiences, level of self-efficacy, and supportive instructional environment) are learners likely to manifest self-regulatory behaviours. What is less well understood, however, is how learners transition from other regulation to self-regulation.

What I am recommending, therefore, are studies that focus on this developmental trajectory. That is, how do students of varying ages or backgrounds take the external prompts and scaffolds embedded within classroom or computer-based environments or provided by teachers, peers, or others and internalize them; make them their own. When does external scaffolding become unnecessary or even distracting for learners who have developed the ability and tendency to self-scaffold or who come to a learning task with the knowledge and interest to engage in self-monitoring?

Concluding thoughts

What I hope I have achieved in this commentary is a successful mapping of the common ground shared by the scholars represented in this Special Issue. This common ground arises from converging evidence found within the diverse theoretical

frameworks and varied programmes of research represented in the pages of this issue. It is my contention that the pursuit of consilience, a unity of knowledge, can be invaluable to those who want to be up to date on the literatures related to levels and regulation of strategies and on approaches to learning. Also, I hold that this convergence of evidence is the point where these diverse theories and programmes of research truly intersect.

Nonetheless, as I attempted to convey, the direction that these programmes of research on levels and regulation of strategies and approaches to learning move in the future has yet to be determined. Whatever course they take, these programmes of inquiry will need to confront barriers that will continue to impede progress unless action is taken. There is no question that diminishing or removing those barriers will demand intensive effort and innovative thinking. Yet, I am confident that those who have been instrumental in plotting the course of these programmes of research in the past, and whose contributions are documented in this Special Issue, are more than capable of confronting whatever challenges lie ahead. I am also optimistic that the ultimate designation for this journey, optimal learning and academic development for all students, is well worth whatever effort and innovation is required.

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