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How discerning patterns develops and affects well-being throughout childhood

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How discerning patterns develops and affects well-being throughout childhood

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ABSTRACT

This review study is a first attempt to map the existing theoretical and empirical literature about a possible core capacity for well-being: discerning patterns. The main research question is: drawing from a multidisciplinary evidence base, what is the empirical and theoretical knowledge of children's discerning patterns and how does it interact with overall child well-being throughout childhood? The review of the literature will contribute to the understanding of discerning patterns as a core capacity for well-being within the Learning for Well-Being framework. The review includes systematic searches in various electronic databases and a selection of studies based on pre-set criteria. From the review of literature, various proxies related to discerning patterns were identified: system thinking, working memory, self-regulation and conformity. Each of these proxies was supported with a stream of literature, but some were hardly supported with empirical findings. Results revealed that for self-regulation there were connections with well-being while there were no links to well-being for the other proxies. Studies tended to focus on preschool and elementary school children, while the youngest and oldest children were hardly studied. Two studies included teachers. In combination with an exploration into the existence and impact of eight other possible core capacities for well-being, this study can contribute to the understanding of core capacities that may benefit child well-being.

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1. INTRODUCTION

The purpose of this study is to map the existing evidence of children's ability related to discerning patterns as a core capacity. To the best of our knowledge, this is the first attempt to map the existing evidence on cultivating the ability to discern patterns as a key core capacity and understanding age-related development, links to well-being and other core capacities, and its levels and application among significant adults in children's lives.

This study reviewed and organized the literature on 'discerning patterns' according to the research streams resulting from a search conducted with multiple keywords and strict inclusion criteria. The relationship between discerning patterns and well-being was explored, and the evidence-based literature found was mapped onto the approach to development proposed by the L4WB theoretical framework.

This literature review has four sections. The first gives the conceptual underpinnings for this working paper on discerning patterns. The overarching background paper of the MWM project, of which this working paper is a part, includes the full background of the Measuring What Matters (MWM) project and the applied L4WB framework. The second section details the methodology employed to search for the literature and the selection of studies. In the third section, the results are described. The fourth section discusses these results in terms of main findings, data quality, limitations, contribution to existing knowledge and implications for future research.

2. CONCEPTUAL UNDERPINNINGS

L4WB linked discerning patterns to "systemic processes" and defined the core capacity as: "recognizing interdependency and the relationship of the parts to the whole" (Learning for Well-Being, 2019, p. 7). About developing the capacity, O'Toole (2016) explained:

> [c]ultivating this core practice begins in a simple way – the awareness of oneself as part of the group and the environment. This implies that you understand (and act from the understanding) that you are influenced by everyone/everything around you, and, in turn, are influencing those people and environments. Seeing the patterns and the relationship between patterns occurs whether it is a matter of developing storms, organizational dynamics, or one's own behaviour. Intrinsically, discerning patterns as a core practice recognizes the impact of me on the world, and the world on me, and my ability to make choices on that basis. (p. 26)

As explained in the MWM background paper, L4WB argued that every capacity can be understood through a physical, emotional, mental and spiritual perspective. Applying the definition of 'discerning patterns' to the four dimensions of L4WB's framework, this capacity is defined or expressed under each dimension as follows (*see Table 1*).

Table 1: Matrix of Four Perspectives: discerning patterns

			SPIRITUAL (S)
	content **'what'**	***process*** **'how'**	***intention*** **'why'**
MENTAL (M)	a *mental perspective* refers to "our cognitive and rational processes" and the functions of "envisioning, planning and valuing" (O'Toole, 2016, p. 17).	"A *mental perspective* of discerning patterns and systems is associated with essential and selective conceptual frames of reference". (Learning for Well-Being, 2019, p. 7).	"At a *spiritual level*, discerning patterns and systemic processes relates to wholeness: what is known, unknown, and unknowable" (Learning for Well-Being, 2019, p. 7).
EMOTIONAL (E)	an *emotional perspective* refers both to "our intrapersonal functions – our inner feelings, motivations and our interpersonal functioning – [and] our interactions with others" (O'Toole, 2016, p. 17).	"An *emotional* perspective on listening is associated with opening and connecting with emotional content, felt intention, the flow of communication"; "an *emotional expression* of patterning is related to tracking human patterns – oneself and others. It is about following the flows of behavior and energetic connections" (Learning for Well-Being, 2019, p. 7).	
PHYSICAL (P)	a *physical perspective* refers to "the physical senses, to our bodies, and to the material and natural environments" (O'Toole, 2016, p. 17).	"A *physical expression* of patterns and systems is associated with repeated patterns and the dynamics of whole systems – their actions and interactions" (Learning for Well-Being, 2019, p. 7).	

All the studies included in this working paper are placed within this Matrix of Four Perspectives (Table 1) and are compared as a complete body of evidence in the discussion of this paper. The application of the matrix to the reviewed literature will illustrate the degree to which the literature helps with the theoretical classification of the core capacity of discerning patterns within the four perspectives of L4WB.

3. METHOD

To conduct the literature review on the capacity to discern patterns in children, a systematic search was conducted in the following electronic databases: Google Scholar, ERIC, PubMed and APA PsychNet.

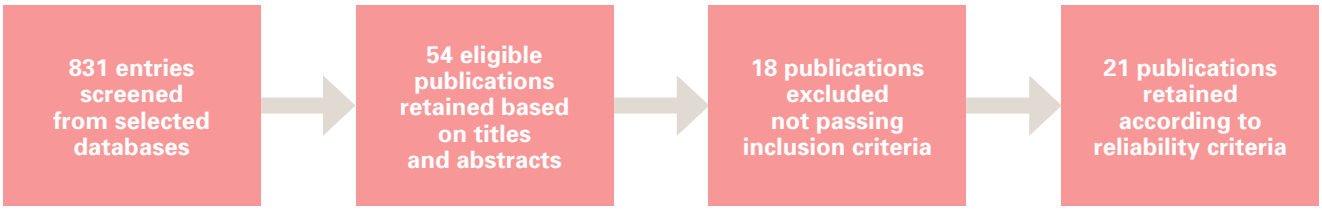
The screening stage retained only peer-reviewed studies. To be included, studies had to fulfil several criteria determined prior to starting the systematic search in order to reduce potential bias. First, each study had to focus on children; that is participants under the age of 18, or adults working with children (i.e., teachers, educators). The ethical considerations of each study were also reviewed but they were not an inclusion criterion for this review. Studies that explored the development of the ability of discerning patterns solely in adults without any links to children or adolescents were excluded.

Furthermore, studies had to fulfil strict inclusion criteria: being conceptually coherent, using appropriate methods, and being scientifically valid (Appendix A). The time frame for inclusion of studies was set at 20 years (1999 to 2019). All searches were recorded, including details for each search, number of studies included at the first screening stage, details of studies rejected at the eligibility stage and list of studies accepted. Duplicates were excluded in the identification phase (*see Figure 1*).

Guided by experts in areas of child development, the search was conducted using relevant and closely related keywords and combinations of keywords: 'discerning patterns', 'discernment', 'system thinking', 'strategic thinking', 'self-regulation', 'conformity', 'working memory', 'abstract thinking', 'understanding patterns' AND child* OR adolescent* AND well-being OR development. All possible combinations of terms across keywords were used separately for each database (i.e., discerning patterns AND child* AND wellbeing/ or discerning patterns AND adolescent* and well-being, etc.). Other keywords used were the following: 'conceptualising capacity'; 'analysing skill'; 'contextualising skill'; 'pattern recognition'; 'differentiating patterns'; 'organizing patterns'; 'complex thinking', 'complex information' in combination with 'children' and 'adolescent', but no relevant results appeared using these rounds of keywords.

All findings were sorted based on the relevance criteria and the first 25 studies were retained for screening for each keyword or combination of words used (i.e., the first 25 studies ordered by relevance found through Google Scholar for 'discerning patterns AND child* AND wellbeing' were screened). For each combination of search terms, the relevant literature was screened by including empirical and theoretical studies. Overall, the searches uncovered 54 papers in total, of which 33 were rejected and 21 were retained for this study.

Figure 1: Records flow



Because there was a gap in evidence on discerning patterns from the perspective of spirituality, an additional search round was conducted. To identify high-quality evidence relating to spirituality and discerning patterns the input of various experts was considered including the Learning for Well-Being Foundation, the Fetzer Institute and individual researchers focusing on spirituality. Among a list of 45 articles/chapters in books, the same key search terms were used in the text of each full article or book chapter in order to search for connections of the discerning patterns capacity linked to spirituality. The inclusion and exclusion criteria were applied to the resulting list of spirituality articles. Moreover, the same quality assurance inclusion criteria as in the general discerning patterns searches applied. After this process, no studies were encountered across the list of articles that were meaningful for the objective of this review. These studies did not explore any connection with discerning patterns (and related proxies) and spirituality in children.

3.1. Applying the Matrix of Four Perspectives

Each of the studies included in the review was positioned within the Matrix of Four Perspectives to determine to what extent the L4WB hypothesis is supported with evidence. The matrix from Table 1 was applied to organize the articles in the various categories (mental, emotional, physical or spiritual) and levels (content, process or intention). More background information on how the matrix was developed and linked to the L4WB framework is available in the overarching MWM background paper.

After the matrix was applied, two of the authors compared the application matrix, discussed the placement of articles, raised questions, and made necessary adjustments. When agreement was not reached the authors checked the application of the matrix again and discussed the papers in question until agreement was reached.

4. RESULTS

This review introduces different constructs for the discerning patterns capacity: working memory, system thinking, self-regulation, and conformity. All of these constructs are considered to be proxies to measure the capacity to discern patterns. The proxies were identified through the application of different search terms that were related to this capacity.

4.1. Working memory and children

At the mental level of the capacity to discern patterns, we considered the literature on the concept of working memory. Working memory appears to be a necessary process of the discerning patterns capacity. The theory showed that working memory "refers to the capacity to store and manipulate information over brief periods of time" (Alloway et al., 2006, p. 1698). It is a necessary mental ability that helps to process information in the short term. According to this definition, working memory seems to be a prerequisite to sustain the capacity to discern patterns, as it is necessary to retain information in order to process and discern it. If children have a weak working memory, the capacity to discern patterns is going to be difficult to apply. Indeed, it could be assumed that if children have a very good working memory, they can retain sufficient points of recent information to discern patterns mentally and make links among different inputs. Results reported in the body of literature on working memory and children are discussed below.

Finch (2019) discussed how working memory (WM) is a necessary skill to support both academic and social outcomes in children. The author implemented a study using a nationally representative dataset of 18,170 children from kindergarten to elementary school, but the final analytic sample was composed of 11,150 students. The study aimed to assess if working memory improves during the school year and if socioeconomic background influenced the results. The children's working memory abilities were tested at different times during the school year in different classes in order to produce estimates of working memory improvements. Results showed that WM improved significantly when children were attending kindergarten and the first year of elementary school, while during the summer break WM rates were lower. The same results were found between the first grade and second grade of school, again showing a decline during the summer break. Overall, children's working memory grew faster in kindergarten compared to the first grade and in first grade compared to second grade. For children from lower income households their working memory grew faster during school periods compared to the children from high-income families. In general, the study demonstrated how schooling facilitates the improvement and practice of children's working memory.

In a similar way, Alloway and Alloway (2010) studied the relationship between working memory and education outcomes among 98 children in the United Kingdom. The purpose of the empirical study was to understand if working memory could be considered as a proxy to measure IQ in children. Children were tested twice, when they were in kindergarten (mean age 5 years) and 6 years later (mean age 11 years). Their IQ, memory and educational attainments were measured by using different test packages. Analysis of correlations revealed that working memory results were significantly associated with learning outcomes, but not with IQ test results. These findings showed that working memory could not be considered a proxy of IQ, but is an independent cognitive skill that has important effects for the achievement of successful education outcomes.

Alloway et al. (2006) studied the components of working memory in a sample of 709 schoolchildren aged 4–11 years in the UK. The authors built a model based on previous literature which stated that working memory capacity is activated when a child needs to acquire complex and simultaneous short-term storage of information. The other feature of working memory is to process the information acquired, which depends on a central resource, called 'controlled attention' and 'executive functioning' (p. 1699). The children in the sample were given memory tasks to measure these two components of working memory. By applying a factorial analysis, it was confirmed that verbal and visuospatial resources in children influenced the capacity to store information in the short term, while the processing of this information depended on a general mechanism, the executive functioning (p. 1713). No sex differences were found in any of these results.

Similarly, Bull et al. (2008) investigated how working memory and executive functioning facilitate the achievement of education outcomes in a sample of 124 children in the UK. The study tested children at two points in time: at four years (at preschool) and at seven, when they reached primary school. The tests aimed to assess cognitive skills (using reading and maths tests) of children. Correlation and regression analysis were applied to results. As in the study above (Alloway et al., 2006), even in this case, both visuospatial short-term memory and executive functioning skills seemed to forecast the education attainments of children when they reached school age.

An interesting study by Flouri et al. (2018) looked into the relationship between contact with nature (green spaces) and the brain, namely the effects of nature on 'spatial working memory' performance in children. Spatial working memory is a component of the working memory and is related to the retention and processing of visuospatial information (p. 360). The authors used the 'UK's Millennium

cohort' to obtain an analytic sample of 4,758 children, with an age range of 11 years, living in urban neighbourhoods, and coming from different socioeconomic backgrounds. Children came mostly from poor families and from diverse ethnic backgrounds. Data collection was based on self-reported questionnaires and interviews both for children and their parents. The 'Environmental Deprivation Index' (p. 361) was used to measure the presence of green areas in urban neighbourhoods (wards), while spatial working memory was tested with the Cambridge Neuropsychological Test Automated Battery (CANTAB). After the implementation of a regression analysis, the results showed that children living in urban areas with a high number of green spaces and areas performed better on spatial working memory, regardless of living in a deprived or non-deprived neighbourhood.

Gathercole et al. (2004) studied the components and the development of a working memory model, called 'Baddeley and Hitch', in 700 children from 4 to 5 years. The working memory model components are the 'central executive' (a related concept of executive functions) which regulate different functions, primarily 'attention', the 'control of action', and 'problem solving' (p. 177). The children were tested on all these three components of working memory across different ages using a battery of different tests: backward digit recall, word list recall, nonword list recall, block recall, and the Visual Patterns Test (p. 179). MANOVA and correlational analysis of data revealed that the applied working memory model appeared in children with all its components at the age of six years and developed strongly through early adolescence.

Another study by He et al. (2019) introduced the concept of 'social working memory'. This is slightly different from cognitive working memory (WM), which is anchored to the process of the cognitive dimension of the mind. The authors defined social working memory as the capacity to retain and process social information and noted that previous studies confirmed that "the brain has evolved neural substrates dedicated to social WM" (p. 1). This empirical study was divided into two different experimental settings. The first experiment was composed of 64 children aged 3 to 6 years, and the second had 144 children aged 4 years. The children were given a task of memorizing stimuli. The findings in the first experiment revealed that the social WM capacity increased progressively with age, especially for children aged between 4 and 5 years.

4.2. System thinking and children

Another concept that appeared from the searches and seems related to the mental level of the capacity to discern patterns is the ability of system thinking. Two studies were identified that focused on system thinking (Assaraf and Orion, 2010; Brandstädter et al., 2012). Two further studies focused on concepts related to system thinking: strategic thinking and prospective thinking. These concepts relate to system thinking in the sense that these thinking skills involve understanding complex social systems (Brocas and Carrillo, 2018; Lombardi et al., 2017).

Assaraf and Orion (2010) studied the development of system thinking skills in children at elementary school. This was studied in an Israeli context of a science programme on the Earth's water systems. The authors described system thinking as a high-order thinking skill and explained that the term 'system thinking' is used to group efforts to examine complex systems, complexity theories, and the ability of children to understand these complex systems. The systems included natural, biological, social and technological ones. The authors focused especially on the development of system thinking skills within the science curriculum, which is criticized for generally supporting learning facts more than developing understanding and 'big ideas'. Based on previous studies, the authors hypothesized that system thinking is within the abilities of primary school students even though it is a high-order thinking

skill. Moreover, the development of system thinking at a young age could support further development of system thinking during high school. The authors developed the System Thinking Hierarchical (STH) model to arrange the various abilities of system thinking in three sequential levels: analysis of system components; synthesis of system components; and implementation. According to this model, mastering the skills of a lower level is a prerequisite for mastering the skills at a higher level. The researchers studied the synthesis of system components ability of children aged 9 to 10 years. The sample of 40 children from one Israeli school was limited. Data were gathered by both quantitative and qualitative research methods. The results were that almost all students were able to analyse the system's components. For the second level of the STH model, most students could identify simple relationships among the components in the system while almost half of the students had the ability to identify complex relationships. At the most advanced levels of system thinking, a third of the students could organize the components in a framework and a fifth of the students managed to achieve cyclic thinking. Additionally, students managed to identify relationships better between components that they learned in outdoor learning activities (in concrete contexts). The authors concluded that system thinking can be developed during elementary school.

Brandstädter et al. (2012) explored if concept mapping is an adequate instrument for analysing students' system thinking. Their study was completed in a German context with 154 students in a primary school grade (with a mean age of 9.95 years) and 93 students in a secondary school grade (with a mean age of 14.07 years). Their central definition for system thinking is:

> A complex and dynamic system can be considered as composed of interdependent and interacting components that either can be physical like objects or intangible like processes, information flows, relationships, feelings, and values or beliefs (Anderson & Johnson, 1997). System thinking can be defined as the ability to understand the multi-level structure of those numerous components, their dynamic and nonlinear relationships (Hmelo-Silver & Azevedo, 2006). (p. 2148).

The authors built upon a two-dimensional characterization and distinguished between structural system thinking ("the ability to identify a system's relevant elements and their interrelationships, altogether determining the system's framework" (p. 2148)) and procedural system thinking ("the ability to understand the dynamic and time-related processes that emerge from the systems' structure, particularly occurring in within systems' elements and subsystems" (p. 2148)). They also pointed to the disagreement about when system thinking should be introduced at school – recognizing both empirical studies supporting the introduction of these skills as early as possible, as well as others arguing that the necessary higher-order thinking skills only develop at an older age. The authors focused primarily on developing an assessment instrument for system thinking through concept mapping. They defined concept maps as "external representations of mental models, consisting of concepts (nodes) connected to each other by labelled lines, in each case building a proposition" (p. 2150). Experimental conditions differed in two factors: degree of directness (how constrained the students were to use specific concepts and linking words) and medium (computer-based or paper-pencil). They found that students in both grades performed better when using computer-based concept mapping, and the authors suggested that computer-based concept mapping "might reveal more realistic insight into students' cognitive structure" (p. 2163). The results did not show significant differences between highly directed versus undirected concept mapping when creating paper-pencil maps. Nondirected computer mapping was not studied because that option was not available in the computer program used. The authors finally suggested that highly directed and computer-based concept mapping is an appropriate assessment tool for system thinking.

Brocas and Carrillo (2018) studied determinants of strategic thinking in preschool. They define strategic thinking as the "intrinsic ability to anticipate actions and act accordingly" and consider it as a key part of rational decision-making (p. 1). The hypothesis of the study was that children can think strategically but cannot translate it into action yet. To test this hypothesis, two constructs were measured: logical reasoning (making logical choices) and anticipatory reasoning (anticipating future events and letting that inform the course of action). The study included 72 children aged 4 to 5 years from various preschool classes in the context of the United States. The experimental study involved completing various strategic thinking tasks of various levels of difficulty. Based on the children's ability to solve the tasks and the manner in which the tasks were completed, they were placed in four groups: strategic thinkers, limited strategic thinkers, alternators and randomizers. The strategic thinkers demonstrated logical reasoning skills, and simple and complex anticipatory reasoning, while the randomizer did not demonstrate any of the relevant abilities. Limited strategic thinkers did not show complex anticipatory reasoning and alternators did not show any anticipatory reasoning but solely local reasoning skills. There were no effects of children's sex in the study. While the age range was small in the study, the researchers found that being classified as a strategic thinker was associated with age. Thus, there were developmental differences in the study and age played a role in the performance of the preschoolers. Overall, the study provided evidence that the children could apply logical reasoning but generally failed to implement anticipatory reasoning in the most difficult tasks. The researchers considered that this is in line with the problem-solving and planning strategies literature that shows how young children only show a limited number of problem-solving and planning strategies while with increasing age they can solve larger problems.

Lombardi et al. (2017) focused on prospective thinking in primary schoolchildren. In the study, prospective thinking was considered as a precursor of strategic decision-making. The hypothesis was that strategic thinking development is related to an ability to delay gratification but not to altruism. Strategic thinking in the context of fairness and delaying gratification are both related to prospective thinking, while altruism is not necessarily related to it. The study consisted of three psychological decision-making tasks: the dictator game (on altruism), the ultimatum game (on fairness and inequality aversion) and the marshmallow task (on delayed gratification). The study included 94 children, aged 6, 8 and 10 years, from two primary schools in the North and Centre of Italy. Overall, there were significant relationships between age, cognitive abilities, fairness and delayed gratification. There was no effect found for socioeconomic status or sex. The authors concluded that part of the performance differences on the dictator and ultimatum game are linked to the implementation of the ability to think prospectively.

4.3. Self-regulation and children

Another group of studies identified in the searches focus on self-regulation. This group of studies is considered relevant for exploring the capacity to discern patterns due to the overlapping idea that discerning patterns entails understanding complex social systems. This group of studies includes studies on self-regulation in general, on different aspects of self-regulation and on different effects of increased self-regulation. Various studies on self-regulation examined emotion-related self-regulation (Eisenberg and Sulik, 2012; Eisenberg et al., 2010; Eisenberg et al., 2000; Kiel and Kalomiris, 2015). Studies on strategic thinking and prospective thinking were discussed in the system thinking section above (Brocas and Carrillo, 2018; Lombardi et al., 2017). The study on prospective thinking in particular included a link to delayed gratification through the marshmallow task, and clearly links to self-regulation (Lombardi et al., 2017).

In a position paper, Haslam et al. (2019) reviewed studies on self-regulation in low- and middle-income countries (LMICs). This is especially relevant since most research on self-regulation originates from the context of high-income countries (HICs). The authors suggested that the context of LMICs with collectivistic cultures is not as suitable for the individualistic conceptualization of self-regulation as that in HICs. The authors considered that the common understanding of self-regulation includes "autonomy, self-control and appropriate regulation of one's own emotions" (p. 9). They questioned the individualistic nature of this understanding of self-regulation, which would fit individualistic cultures better (p. 9). The authors considered that overlapping conceptualizations such as collective efficacy may provide more explanatory power for positive outcomes in collectivistic contexts. "Collective efficacy is a form of 'collective regulation' that refers to communities' capacity to control and/or direct the behaviour of individuals and groups in order to create safe and orderly environments" (see Bandura, 2000 as cited in Haslam et al., 2019, p. 9). The self-regulation construct applied included concepts with a behavioural definition and a cognitive definition including: emotion regulation, reflective functioning, ego resiliency, self-control, grit, executive function, and mentalization. Moreover, different aspects of self-regulation included inhibitory control, reflexivity, emotion regulation and metacognitive strategies. Relating to well-being, Haslam et al. (2019) acknowledged that "self-regulation is an essential capacity for healthy development and functioning" (p. 1). Moreover, various studies provided evidence that "self-regulation is associated with physical, mental, social and emotional health, increased academic performance, and better life outcomes" (p. 1). Haslam et al. (2019) recognized that the capacity develops during early childhood and parents play an important role in the development process (due to their own abilities affecting their environment but also helping children acquire the skills).

In a study on differences of children's conscience development, early developmental aspects of self-regulation were examined (Kochanska and Aksan, 2006). Conscience was defined as "an inner guiding system responsible for the gradual emergence and maintenance of self-regulation" (p. 1587). During early life young children depend on external regulation, while they become increasingly self-regulated. Both biological (temperament characteristics) and social (socialization experiences and early relationship with caregivers) differences were considered. Three longitudinal studies were conducted which focused on moral emotions and moral conduct as components of conscience. The results were that children demonstrated individual differences in moral emotions and moral conduct early in life. These differences possibly reflected the personality systems of the child and remained stable over time and across situations. One of the characteristics that was considered was a child's willing stance toward parental directives and demands. This characteristic predicted components of conscience, and remained consistent across situations and over time. The major predictors of conscience development were temperament (both fearfulness and effortful control) and family socialization. A recommendation from the study was that further studies into self-regulatory capacities should consider the complex interplay between temperamental characteristics and socialization in children.

In the context of the United States, Atherton et al. (2019) studied developmental precursors of effortful control. Effortful control is the temperamental core of self-regulation and is "a temperament trait that involves the propensity to regulate one's impulses and behaviors, to motivate the self toward a goal when there are conflicting desires, and to focus and shift attention easily" (p. 417). Effortful control includes top-down regulatory and motivational processes. The study built on the disruption hypothesis, according to which self-regulation traits temporarily dip during adolescence. After this dip, self-regulation traits increase with age again. There is no consensus about the patterns of development of effortful control (consisting of inhibitory control, attention control and activation control). A large longitudinal study was conducted including 674 young people aged 10 to 19 years and their families.

In line with the ecological systems theory, various environmental systems that may impact child development were considered including: individual, family, social influence, community, and cultural systems. Various aspects influenced the strength of the dip in regulatory traits. Consistent with previous research, the data showed a temporary dip in adolescence for effortful control. Individual differences in the strength of the dip were found with some children who experienced a strong dip while others did not. The components of effortful control were found to develop in various ways. Inhibitory control increased linearly in children aged 10 to 19 years and did not show a dip. Attention control decreased linearly in the same period. Activation control, including motivational and goal pursuit tendencies, showed a clear temporary developmental dip. The strength of the self-regulatory dip that some experienced during adolescence was related to the environmental system measures and the changes within these systems. For instance, the young people demonstrated a bigger dip when they experienced more parental hostility, more relationships with deviant peers, more violent schools, and more ethnic discrimination. They demonstrated a lesser dip in effortful control when they had parents who closely monitored their behaviour. Sex and socioeconomic status did not influence the effortful control development.

Von Suchodoletz et al. (2013) considered behavioural self-regulation and academic skills in children in Germany and Iceland. In earlier studies, self-regulation was described as a predictor of academic and social competences and as critical for school readiness. In the study, self-regulation was defined as a "comprehensive construct that describes people's capacities to regulate emotions, cognition, and behaviors" (p. 62). The study was conducted with 190 German children and 222 Icelandic children aged between 4 and 6 years. The researchers measured behavioural self-regulation through a direct assessment of Head-Toes-Knees-Shoulders, through a questionnaire into teachers' assessment on behavioural self-regulation using the Child Behavior Rating Scale and various other measures of children's academic achievement. The results were that higher levels of behavioural self-regulation related to higher academic skills, with a relationship between the two constructs that was more important than background variables such as sex and age. Sex influenced the results in both the German and Icelandic contexts especially on the teacher-rated measures, in which girls' performance was rated higher compared to boys' performance.

In another empirical study, children's self-regulation and their adaptive behaviours in the classroom were examined (Rimm-Kaufman et al., 2009). The central construct was defined as follows: "[s]elf-regulation refers to children's ability to manage their emotions, focus their attention, and inhibit some behaviors while activating others" (p. 959). In this study, the broad construct of self-regulation was considered, involving emotion, attention, behaviour and cognition. The study included 172 children aged 4 to 6 years in the United States. Data were gathered through direct assessment tasks on self-regulation, classroom observations and teacher questionnaires. Early self-regulation tested in autumn predicted the teacher's report of more behavioural self-control, more cognitive self-control and better work habits in spring the next year. Moreover, adaptive classroom behaviour was predicted by classroom quality, especially by effective classroom management. A well-managed classroom was shown to be relevant as a stage for children to develop their self-regulation further.

The searches revealed a few studies on emotion-related self-regulation. In a longitudinal study, emotionality and regulation and their relationship to social functioning were investigated (Eisenberg et al., 2000). The study included 142 children from 7 to 9 years who completed assessments on two occasions. The effect of attention regulation on social functioning was mediated by resiliency at the first assessment. At the second assessment, this relationship was additionally moderated by negative emotionality. Moreover, negative emotionality strengthened the relation of behaviour regulation

to socially appropriate or prosocial behaviour. During this study the authors recommended the exploration of different types of regulation, which was done in later publications discussed below.

In 2010, Eisenberg et al. reviewed the literature on effortful emotion-related self-regulatory processes. Effortful control includes abilities such as shifting attention, focusing, inhibitory control, activation control, executive functioning and attention skills. The review explored many aspects of emotion-related self-regulation. Relevantly, in reviewed studies self-regulation developed with age, and developed especially quickly in the early years of life while development was slower during adulthood. After the first year or two of life, the individual differences in self-regulation remained constant. Self-regulation was negatively related to some types of externalizing problems and there was some evidence of a negative relationship with internalizing problems as well (after early childhood). Studies have identified self-regulation interventions that can effectively reduce maladjustment. Again, there seems to be a clear link with well-being.

In a theoretical review paper, Eisenberg and Sulik (2012) reviewed conceptual issues of emotion-related self-regulation. In the reviewed studies self-regulation measures were consistently related to children's positive adjustment and less maladjustment (p. 80). There seems to be a clear link with child well-being. The authors concluded from the studies reviewed that self-regulation includes "basic skills that develop from the early years into adulthood" (p. 81). Self-regulation skills in the reviewed studies predicted both social competence and maladjustment.

In another literature review on emotional regulation, the parent–child relationship was specifically explored (Kiel and Kalomiris, 2015). Previous studies identified attachment relationship and parenting behaviours as foundational for emotional regulation in children. Studies provided evidence of how both mothers and fathers were influential in infancy and had influences on emotion regulation in unique domains. Recent studies provided evidence of how parenting can be influenced by the child's emotion displays and regulation strategies. The review considers culture as a context for the development of emotion regulation. This can occur through parents communicating emotion-related values, culture impacting parent–child processes, and cultural values, demands and expectations impacting emotion-relevant physiology. The relationship between parental emotion socialization and emotion regulation in their children exists across different cultures and different socioeconomic levels. The authors suggested the importance of considering differences within cultures, such as regional differences and the level of traditional values.

4.4. Conformity and children

A number of studies on conformity were identified during the selection process. This concept is related to the capacity of discerning patterns as children, by observing and discerning systems, understand their surroundings and can learn, from other children or adults, to conform to the rules and practices of society. This concept is connected to the action of discerning behaviours and rules, and to the process of adhering to them. Conformity and imitation are behaviours which belong to social learning processes and to creating an understanding of reality. Psychologists and social anthropologists have argued that these social behaviours relate to the shaping of cultures.

For example, Hodges (2014), in a theoretical review, showed how empirical studies provided evidence that children learn and understand the world, others and themselves in relationship with others. In this process, imitation behaviours and conformity have a central role when children act and explore the world. Indeed, the authors stated that children sought and used information from others, produced the

same patterns and sought "social appropriateness" and "prudence" (p. 9). The evidence suggested that children learn from others and about themselves within society "in a way that allows them to act appropriately and effectively" (p. 9). Hence the act of imitation and conformity are necessary behaviours inherent in the socialization process.

Haun and Tommasello (2011), in their empirical study on children, stated that individuals often tend to conform their behaviours and ideas to peer groups, regardless of whether they agree with those behaviours and ideas. The experimental study was composed of 96 children aged 4 years, divided in 24 groups of 4 each, from a kindergarten school in Germany. In every group there was one child in a minority position ('minority child', p. 1760). The sample was distributed equally in terms of males and females among the minority child group. Moreover, in all groups, the child in the sex minority was never the minority child. The children were given a task to understand if the minority child in the group would conform to the choices of the other three children. Results showed that most of the 'minority' children aligned their opinions to their three peers' judgements, even though their former judgement was different. Of 24 minority children, 18 conformed at least once, and 10 conformed more often than not. A follow-up experiment with 18 groups revealed that children belonging to the minority group did not really change their original idea on the situation, but when revealing it in public in front of the other children, they conformed to the idea of the majority group. These results revealed how children can be influenced by peers at a very young age, and demonstrated the importance of the group in the socialization process and in decision-making.

In a similar way, Cho and Chung (2011) explored conformity behaviours in bullying situations in a sample of 391 adolescents (285 boys, 106 girls) aged 13 to 14 years from a school in South Korea. The experiment aimed to measure peer conformity and peer pressure in teenagers experiencing potential bullying perpetration attitudes. The authors discovered that peer pressure is a strong influence in social and non-social conformity. In bullying situations, peer pressure and resistance were opposing forces that influenced the level of participation in peer bullying episodes. The individual capacity to detach from peer pressure and act in opposition to peer conformity reduced the level of participation in bullying situations among adolescents.

From the studies described above, it is clear how children act, express and take decisions by conforming to group behaviours. Indeed, results showed how individual children's actions and behaviours are influenced ultimately by the group of peers and peer pressure. Conformity to the group of peers is somehow necessary for the socialization process during the developmental phases of childhood. In this sense, peer conformity behaviours seem closely related to the recognition of patterns and rules – especially to those patterns and rules related to living and acting in society and having relationships with others.

4.5. Discerning patterns and its physical, emotional, mental and spiritual dimensions

The studies included in this literature review were categorized using the Matrix of Four Perspectives (*see Table 2*). Of the 21 studies included in the matrix, the vast majority were placed in the process level of the matrix. Studies focused on the mental, emotional and physical dimensions of discerning patterns. A noticeable difference with the results from other mapping papers was the overlap between various dimensions in many studies. Some studies included the mental, emotional and physical dimensions. Many studies considered both the mental and emotional dimensions. No results were found for the spiritual level of discerning patterns, and none of the studies sought to understand why children engage in discerning patterns or any of its related constructs. According to the L4WB approach

children engage in discerning patterns "in order to understand how their world works" (O'Toole, personal communication, 30 June 2021). The results show that the capacity to discern patterns demonstrates clear mental and cognitive characteristics such as working memory skills, attention control and system thinking. These studies can be placed under the mental perspectives of the L4WB framework. The studies placed under the emotional dimension dealt with concepts that were related to relationships (conformity) and self-regulation characteristics (emotion-related self-regulation) and influences on that proxy. By contrast, the physical dimension is hardly supported by the literature. The studies included in this mapping paper understand discerning patterns as a construct mainly made up of mental features.

Table 2: All studies in the Matrix of Four Perspectives

			SPIRITUAL (S)
	content **'what'**	***process*** **'how'**	***intention*** **'why'**
MENTAL (M)	0 studies	15 studies[1]	0 studies
EMOTIONAL (E)	0 studies	11 studies[2]	
PHYSICAL (P)	0 studies	7 studies[3]	

Note. One study was not placed.[4]

1 The 15 studies placed at the Mental (M) process level are: Alloway & Alloway (2010); Alloway et al. (2006); Assaraf & Orion (2009); Atherton et al. (2019); Broas et al. (2018); Bull et al. (2008); Eisenberg et al. (2000); Eisenberg et al. (2010); Eisenberg et al. (2011); Finch (2019): Gathercole et al. (2004); Kochanska et al. (2006); Lombardi et al. (2017); Rimm-Kaufman et al. (2009); Von Suchodoletz et al. (2013).

2 The 11 studies placed at the Emotional (E) process level are: Atherton et al. (2019); Cho & Chung (2011); Eisenberg et al. (2000); Eisenberg et al. (2010); Eisenberg et al. (2011); Haslam et al. (2019); Hodges (2014); Huan & Tommasello (2011); Kiel et al. (2015); Kochanska et al. (2006); Rimm-Kaufman et al. (2009).

3 The seven studies placed at the Physical (P) process level are: Flouri et al. (2018); Gathercole et al. (2004); Haslam et al. (2019); He et al. (2019); Huan & Tommasello (2011); Kiel et al. (2015); Rimm-Kaufman et al. (2009).

4 The one study not placed is: Brandstädter et al. (2012).

5. DISCUSSION

This paper introduces different constructs for the capacity to discern patterns, which are working memory, system thinking, self-regulation, and conformity. These involve both behavioural and cognitive concepts. An overall trend for all of the constructs is that studies from within the different constructs all acknowledged the importance of the child's environmental systems in influencing discerning patterns. These include urban environment, individual, family, social influence, community and cultural systems from the ecological systems theory as applied by Atherton et al. (2019).

The studies on working memory showed how this skill is strictly related to the core capacity for discerning patterns, as it is necessary to retain information in the short term in order to be able to discern patterns. The studies reviewed described working memory as a skill which helps children to store a great and complex amount of information in the short run and to process it. Indeed, findings revealed that in order to process complex and different information (from cognitive to visuospatial information) working memory needs to be developed and enhanced throughout childhood.

From the articles on system thinking it emerges that there is a discussion on the relevance of system thinking development in young children. Various studies focused on evidence of the importance of developing these higher-order skills for children at a younger age than previously thought. Development at a young age creates a platform or basis to build on when children are older and develop their system thinking further. The central constructs of the system thinking studies varied. They included various types of system thinking, for instance understanding natural systems in the science curriculum but also prospective thinking, strategic thinking and decision-making in social systems. Some studies involved the developmental differences in children showing related skills such as strategic thinking and prospective thinking. Both studies found the influence of age positively influencing performance in such thinking skills.

The literature on self-regulation included vastly different constructs. Various literature reviews in the field showed that self-regulation can include many constructs. One study clearly set out all different behavioural and cognitive concepts associated with self-regulation (Haslam et al., 2019). One study considered effortful control as a concept included within self-regulation while another focused mainly on child conscience as a related construct. A few studies focused on emotion-related self-regulation. Other studies considered the impact of increased self-regulation on desirable traits such as improved academic skills and adaptive classroom behaviours. A common line in these studies was the role of both the individual child and their environment in influencing the child's self-regulation. For instance, both child individual characteristics and family socialization influenced early development of aspects of self-regulation such as conscience (Kochanska and Aksan, 2006). Interestingly, from another reviewed study it emerged that some associated constructs did not demonstrate an increasing development with age but demonstrated a temporary dip with an increase in age, self-regulation in general and the activation control measure of effortful control specifically (Haslam et al., 2019). Of the 9 studies on self-regulation, 4 studies were reviews of the literature and did not include primary data, 1 study considered infants or toddlers, 2 focused on preschool children, 1 considered elementary school children and 1 focused on high school children and beyond. This shows a limited empirical basis to draw from in this working paper. Of the 5 empirical studies, 4 were conducted in the context of the United States. In one study samples of German and Icelandic children were compared. One of the review studies explicitly discussed contexts and the overrepresentation of measures developed in high-income countries (HICs), which are only questionably applicable to LIC contexts, and concluded that more data need to be gathered from low-income countries (LICs).

Finally, the concept of conformity was explored as a proxy in relation to the capacity of discerning patterns. Only three studies were reported in this literature review regarding this concept. Results showed that conformity is a construct related to the emotional dimension of the discerning patterns capacity, according to the L4WB framework. Indeed, conformity is studied in literature as a children's behaviour which happens during the socialization process. Children learn, understand and explore the world by conforming or not conforming to social rules, by observing and imitating peer group behaviours (e.g., bullying behaviours) or adults' behaviours. Specifically, discerning patterns is a capacity which is also related to the act of performing relationships and behaviours in daily life: children, by observing and understanding social systems, and social relationships and dynamics, can learn to act and make decisions for themselves and in relation to others, in conformity to the rules and cultural practices of society surrounding them (or in opposition to the same rules).

Overall, there was no effect of gender on child performance in these studies, and various cultural or socioeconomic backgrounds taken into consideration did not reveal further notable implications for children. Notably, most of the studies do not have a clear life course perspective when targeting children. Specifically, the reviewed evidence is mostly based on children in middle childhood (6 to 11), and early adolescence (11 to 13). Only a few studies took a longitudinal approach. The review provided hardly any comparative angle across country contexts, and many of the empirical studies involved limited samples (only two studies were nationally representative). Furthermore, most of the studies were not experimental; many were case studies and non-randomized trials.

There are few training intervention evaluations studies that monitor and foster discerning patterns skills, and even less regarding training for teachers in the school environment. Indeed, the literature review did not find any evidence of the effects of discerning patterns and its proxies in relation to teachers working with children, especially in schools (only one study).

In conclusion, evidence from the available literature shows that discerning patterns and its proxies is a capacity related to the mental and emotional development of children, with limited evidence of the physical dimension. The spiritual dimension of discerning patterns, according to the L4WB framework, is not represented in the reviewed studies.

5.1. Complementarity with other core capacities and well-being

The literature rarely included a focus of the complementarity between discerning patterns and other core capacities. Evidence showed a rather poor complementarity of discerning patterns with other core capacities. When an interlinkage could, however, be observed discerning patterns was related to the observing capacity in three studies through proxies of executive attention and attention control inherent in the working memory capacity (Alloway et al., 2006; Gathercole et al., 2004; Finch, 2019).

Moreover, studies into self-regulation showed overlaps with other core capacities including reflecting and observing. Self-regulation constructs are generally considered to include reflective functioning and metacognitive strategies (Haslam et al., 2019). These studies show a clear overlap between the core capacity of reflecting and that of discerning patterns. Constructs within self-regulation such as effortful control, which again includes attention control, clearly link to the core capacity of noticing (observing) as well (Atherton et al., 2019).

Another focus of this study was to capture the interlinking of discerning patterns with well-being outcomes for children. Various studies related more and better self-regulation to better life outcomes,

better academic performance and increased health: physically, mentally socially and emotionally (Haslam et al., 2019). In the field of self-regulation, studies on emotion-related self-regulation linked to well-being by including how measures of self-regulation have been associated with better adjustment and less maladjustment in children (Eisenberg and Sulik, 2012; Eisenberg et al., 2010).

5.2. Limitations

A limitation of this study was the multifaceted construct of discerning patterns. It was a challenge to include the relevant constructs in depth due to the many related constructs that at times overlapped with other core capacities. These included noticing (observing) and reflecting, and are supported with different streams in literature. This seemed to be the case especially for the broad and well-studied proxy of self-regulation. It was also a challenge to find the right proxies to encompass what was intended by the initial concept of discerning patterns. This was partially due to the broad definition of core capacities in the L4WB approach.

A similar limitation as in the other mapping papers was the lack of global applicability of the resulting studies. Again, a majority of papers originated from the United States and European countries. Only studies published in English were considered, and studies written in other languages were therefore excluded.

As in the other mapping papers, a limitation was that there was a sole focus on typically developing children, causing many children, who are not developing typically, to be left out of this overview.

Moreover, the empirical evidence explored in this review didn't sufficiently cover the role of educators in children's life in relation to discerning patterns, namely teachers. Most of the empirical studies were performed within psychology and neuroscience, while other disciplines are not well represented.

In addition, no intervention training programmes studies to foster discerning patterns skills appeared in the search. Finally, studies lacked similarities in the methodological tools, enrolled samples and measured outcomes. This has led to difficulties in comparing the true effects of the discerning patterns proxies on social outcomes and well-being.

5.3. Implications for practice and next steps

This was a first attempt to review the literature to understand discerning patterns as a core capacity within a child's development, which could possibly benefit the child's well-being. In combination with an exploration into the existence and impact of the eight other suggested core capacities for well-being, this study hopes to contribute to stimulating practices supporting children's well-being.

Overall, there is still a gap in the literature regarding discerning patterns and the practices that could foster it. For most proxies, empirical studies are scarce and, in some cases, did not use sufficiently large sample sizes. Furthermore, there is a need to map the complexity of the skills related to discerning patterns to better capture this inner and intrinsic capacity in children and young people and its effects on well-being.

Furthermore, future studies need to develop appropriate qualitative and quantitative measurements, using larger samples, for each of the proxies described (system thinking, conformity, self-regulation, working memory) to capture its effects when it comes to children. This means that future research

should focus more on large-scale studies with the same programme characteristics for targeted child age groups, in order to compare and analyse results using the same methodology.

This review has suggested that the concept of discerning patterns is not well supported by evidence regarding the four related dimensions of well-being (mental, physical, emotional and spiritual) proposed by the L4WB framework. As such, additional research might help to expand or specify the concept of discerning patterns, covering all dimensions suggested by the L4WB framework (especially the physical and spiritual aspects), as well as training programmes and practices to foster it.

In addition, research is needed to understand the discerning patterns skills and practices surrounding teachers and educators working with children and how these can be transferred effectively to children. School environments can provide a safe setting for children and these types of studies can be easy to implement, involving benefits also for teachers. Thinking of future research, studies should also target vulnerable groups, such as children who left school and are exposed to difficult social and political contexts (conflict or poverty) or in specialized care settings. As such, other informal educational contexts should be explored by research to capture these vulnerabilities.

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APPENDIX A: QUALITY INCLUSION CRITERIA

	Criteria	Sub-categories	Description
1	What does it mean for a study to be **Conceptually Coherent**?	Introduction	Topic, purpose, and study rationale are clearly stated.
		Literature Review	The relevant conceptual underpinnings of the issue are fully explained.
		Research questions	Research questions and/or hypotheses are well defined and drawn from sound evidence-based theoretical or conceptual framework.
2	What does it mean for a study to use **Appropriate Methods**?	Methods	The research design and sampling are appropriate for the study. The study includes a well-articulated rationale.
		Theory (especially for studies with a primary theoretical framework)	A sound and established theoretical line is present.
		Data	Relevant data have been employed. Where survey data are used, the sample is well described and clearly appropriate for the task at hand.
		Analyses	The procedures and measures have been selected correctly and applied correctly.
3	What does it mean for a study to be **Scientifically Valid**?	Results	The results of the statistical/empirical tests fully and correctly interpreted. Basic statistical information, such as probability stats, sample sizes, etc., and coherent explanation of findings are included - avoids overstating the study's importance and generalizability.
4	**Ethics (important but not a requirement to be accepted**)	Ethical review	If the research involves primary data collection and/or the use of sensitive secondary data, ethical considerations are described in the study. For example, the article might include details of the procedures followed to ensure the ethical review of data, an indication that the study received the proper oversight from review board or any mitigation strategies.

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