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## A Socio-Cultural Approach to Growth-Mindset Pedagogy : Maker-Pedagogy as a Tool for Developing the Next-Generation Growth Mindset

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## **A socio-cultural approach to growth-mindset pedagogy**

### ***Maker-pedagogy as a tool for developing a next-generation growth mindset***

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#### **Abstract**

The purpose of this paper was to examine mindset research from a sociocultural perspective, analyze the interrelation between mindset and social representations, and expand mindset discourse from intelligence and giftedness to the creativity domain with maker-pedagogy. Although mindset research has traditionally been anchored in personality psychology, the present paper argues that mindsets reflect social and cultural practices of schooling and associated cultural beliefs and social identities. Experienced societal and educational realities shape implicit ability beliefs and reflect social representations shared by families, teachers, and peers. Because the rapidly transforming knowledge society requires all citizens to solve non-routine problems and pursue novelty and innovation, it is critical that young people believe in their potential to stretch their intellectual and creative capabilities and build new talents through sustained efforts. Hence, deliberate cultivation of a growth mindset is not only beneficial for young people's educational and professional trajectories but also a societal necessity.

#### **Keywords**

Growth-mindset pedagogy – Mindsets – Maker-pedagogy – Knowledge-creating learning – Social representations

## Introduction

Humans are facing increasingly severe problems and risks related to climate change, sustainability, and radical inequality. Investigators are concerned with the growing ingenuity gap (Facer, 2011; Homer-Dixon, 2001) between such challenges and current educational practices, which do not empower students' growth mindset. Productive participation in the emerging innovation-driven knowledge-creation society and building a sustainable future will require the cultivation of sophisticated knowledge-creation competencies by all citizens. Instead of merely promoting intellectual elites, all citizens need better capabilities to see things from fresh perspectives, enhanced self-efficacy, and deliberate stretching of competencies and associated identities as potential knowledge creators (Paavola et al., 2004; Paavola & Hakkarainen, 2014). The revolution of socio-digital technologies is profoundly transforming the tools and environments of human activity and collectivizing all spheres of human learning, working, and everyday activities (Hakkarainen et al., 2015). Human capabilities are extended through social learning, collaboration, and knowledge and competence sharing. Today's increasingly challenging problems require people to capitalize on their heterogeneously distributed knowledge and competences to jointly achieve results far beyond what they could achieve on their own. However, schools have only started to capitalize on the power of social-collaborative learning and teaching enabled by the development of socio-digital technologies.

The dominant tradition of viewing intelligence, giftedness, and creativity as pre-given and fixed individual abilities is increasingly problematic. Research on people's implicit ability beliefs, that is, their mindsets, has traditionally relied on personality psychology and narrow social cognition aspects, whereas the more profound social and cultural aspects of mindsets, highlighted by recent societal changes, have received little attention. The purpose of the present chapter is to reflect on mindset research from a sociocultural perspective conceptually and theoretically. We propose that implicit theories, i.e., assumptions and lay beliefs regarding intelligence, giftedness, and creativity, are embedded in and internalized from socio-historically developed social representations (Moscovici, 1961). These social and cultural connections are critical when studying young people's mindsets, fostering a growth mindset, and developing the growth-mindset pedagogies required by the ongoing societal and digital transformations. We will first review the dominant individualist tradition of mindset research and associated interventions

and provide sociocultural interpretations of these findings. Second, we will examine social representation theories and their application for studying mindsets in educational contexts. Third, we will address the creativity mindset and associated efforts to bring maker culture elements to schools and foster maker mindsets.

### **Mindset research and its educational significance**

Mindset research is based on the study of implicit theories of human qualities, such as intelligence, giftedness, and creativity. Such “theories” are defined as laypeople’s mental representations and, in the present context, as subjective beliefs and assumptions regarding capabilities held and used at school and in everyday life. More specifically, in Carol Dweck’s mindset research, participants believe human capabilities are either non-malleable or malleable; however, such beliefs appear unrelated to independently measured intellectual abilities (Macnamara & Rupani, 2017). A fixed mindset (also called entity theory) is a belief that personal abilities are unchangeable and stable. In contrast, subscribers of the growth mindset (also called an incremental theory) view these abilities to be dynamic and subject to development and enhancement (Dweck, 2017). There is considerable evidence that intelligence mindsets form the core of meaning systems that play an essential motivational role in personal educational and professional pursuits (Claro et al., 2016).

Implicit ability beliefs are embodiments of mindsets people most commonly hold. Fixed, and growth mindsets exist in all people and usually vary between situations and contexts. Generally, young people tend to prefer one mindset over others, but it is common to hold different mindsets in various domains (e.g., intelligence, giftedness) (Dweck, 1999; Kuusisto et al., 2017). Mindsets of intelligence could explain why some people care more about “*proving*” their cognitive ability while others care more about “*improving*” theirs (Dweck & Leggett, 1988). People with an intelligence-related growth mindset orient toward developing their capabilities through sustained efforts and appear less judgmental toward others (Dweck et al., 1995). While a fixed mindset leads young people to give up and avoid challenges that could provide learning opportunities, a growth mindset encourages the agent to seek challenges, be persistent, and put in long-standing efforts to overcome obstacles and develop intellectually (Molden & Dweck, 2006).

What is exciting about mindset research is its expansion to interventions, which have yielded promising results (Bettinger et al.,

2018; Paunesku et al., 2015; Yeager et al., 2016). A growth mindset can be taught to students through social, emotional learning interventions that strive to motivate and empower students to take responsibility for their learning (Yeager & Dweck, 2012; Yeager & Walton, 2011). For instance, Blackwell et al. (2007) conducted an eight-session intervention for seventh students whose math grades had deteriorated. The mindset intervention group read an article aloud called “You Can Grow Your Intelligence,” which argued that the brain is like a muscle, and you need to work and try hard to learn. The group discussed how learning makes people smarter and to avoid labels of dumb or stupid. The study reported significant changes in the intervention group’s math grades and mindsets after the intervention. The authors stated that changing the way students think about math and learning made them more motivated because they now understood that they are in charge of their learning. Learning about growth-mindset dynamics decreased the effects of stress on students’ academic performance and exclusion after the transition to high school (Yeager et al., 2014). Yeager et al. (2019) argue for self-administered, brief, and scalable interventions conducted through a website for students. These scalable interventions are cost-effective and can be administered to all students. However, Dweck and her school’s approach to the mindset appear to undertheorize the cultural mediation involved in associated interventions. Such mediation occurs when providing students with scientific knowledge about the super-plasticity of the human mind (Donald, 1991); such reflections remediate subsequent learning efforts. Correspondingly, asking students to write letters for subsequent cohorts of students about their struggles of overcoming belonging uncertainties can be understood as Vygotskian (1978) double stimulation (i.e., creating artifacts for remediating learning processes). Further theoretical analyses of various intervention tasks could improve our understanding of the socio-cultural reasons for their effectiveness.

### **Mindsets as social representations**

The research on implicit ability beliefs superficially differentiates between implicit (i.e., laypeople’s beliefs and opinions) and explicit theories (i.e., scientific theories) (Furnham, 1988). Investigators have tended to consider these two types of cultural knowledge as inherently separate from one another; many studies have focused on examining how implicit beliefs influence how we assess ourselves and others around us from an individualized perspective (Glăveanu, 2011). Thus, it is critical to ask

where implicit beliefs and assumptions about intelligence, giftedness, and creativity, actually originate. Sociocultural research views all human attributes as profoundly socially and culturally mediated. Mental representations in general, and implicit ability beliefs in particular, do not come from the depths of the human mind but are appropriated from the social environment and enacted cultural practices, representing internalized cultural models (Holland et al., 1998; Vygotsky, 1962, 1978). Cultural practices mediate our views of prototypically intelligent, gifted, or creative persons and how we value their characteristics. In contrast to Runco (1999), who sees such implicit ability beliefs as mindsets residing in the individual's mind and personality, we believe that such beliefs are appropriated from the social and cultural environment and shared with others through everyday cultural-communicative practices and acquired values and attitudes.

The theory of social representations explains how individuals appropriate and apply dominant representations regarding, for instance, intelligence. Moscovici (1961, 2000) proposed the idea that human cognition cannot be seen as simple mental structure; rather, it is mediated socially and historically. Shared social representations are defined as a system of values, attitudes, and practices with two functions: to create order by which the socio-material world is controlled and ease communication within the community (Sakki et al., 2014). Conceptions of intelligence, giftedness, and creativity can be seen as emotion-laden social representations that provide meaning and value to everyday events and communicate our experiences to others (Mugny & Carugati, 1989). We argue that mindsets cannot be treated as mere mental representations but as fundamentally social constructions manifested in our language and social interaction. Thus, implicit beliefs are connected to prevailing social and cultural realities and associated socially mediated knowledge structures. They are shaped through interaction with family, friends, teachers, and media, mediating developmental and educational cognitive socialization.

Moscovici's theory of social knowledge addresses the transformation of knowledge as it "travels" through different communities and social milieus (Moscovici 2000; see also Vygotsky, 1962). Hence, the popularization of the dominant differential psychological theories on intelligence, giftedness, and creativity shaped implicit theories through anchoring and objectification. Anchoring involves merging the phenomenon as a natural part of the social group's existing beliefs, assumptions, and meanings systems, while objectifying saturates communicative processes through the target phenomenon (Moscovici,

2000, p. 49). Notions of intelligence are simplified and selectively constructed according to participants' cultural practices and norms. Mindset interventions are impactful because they prove new, more expansive ways of objectifying and anchoring the targeted ability concepts and, thereby, provide novel possibilities for action and development.

Kärkkäinen et al. (2008) found that students' conceptions of the malleability of their academic competence became more pessimistic throughout the school years. Students tend to internalize the fixed mindset embedded in institutionalized categorization practices and develop their sense of ability through normative assessment practices and everyday feedback. The authors argued that "classroom practices convert the school's view on [students'] abilities into children's representations of their competencies" (p. 446). A fixed mindset may appear adaptive for making sense of strongly stratified societies with intensive cognitive categorization. Hacking (1999) argued that scientific categorizations affect people's ways of making sense of themselves and their subsequent activities and development trajectories. With the so-called looping effect, people tend to take up and act upon human categorizations they are subjected to, gradually changing their identities (see also Holland et al., 1998). Consequently, educational categorization practices may transform the kind of people students consider themselves to be, shaping their activity, learning, and development significantly ways, thereby leading to the concrete social construction of reality. Simultaneously, teachers', parents', and other stakeholders' implicit or explicit categorizations constrain and limit young people's intellectual and creative development.

Räty et al. (2004) defined two spheres of education—restrictive and promotional spheres—arguing that both are current prevailing school practices. The promotional sphere is related to the school's goal to develop every student's skills and competence and incorporate a belief that competencies can be developed and stretched; hence, school institutions tend to have a growth mindset. The restrictive sphere of education, in contrast, is related to school assessment practices that compare students' abilities and rank and assess students. These competing ideas produce a paradox in school practices, where teachers operate and make rapid pedagogical decisions and assumptions about students. Räty et al. (2018) suggested that students' "ability self"—a conception of one's ability "profile," which includes the mindsets and feelings of self-efficacy—develops through one's history and is influenced by normative comparisons imposed by school institutions.

When educational institutions view intelligence as fixed and stable, children tend to be categorized into groups of, for example, more or less able, intelligent, or unintelligent. A longitudinal study by Boaler et al. (2000) revealed that placing students into math “ability” groups creates a set of expectations for teachers that overrides their awareness of individual capabilities. Teachers constructed students as successes or failures based on their location in a “set,” not due to their personal academic qualities, and had preconceptions about students’ appropriate level and pace of studying in their selected math ability group. Adopting ability-grouping appeared to signal teachers that it was appropriate to use different pedagogical strategies from those they used with mixed-ability classes. Nevertheless, in their famous Pygmalion study, Rosenthal and Jacobson (1968) told the teacher that a group of ordinary students were exceptionally talented. After one year, the students’ academic achievements and the teacher’s assessment of their capabilities were far above the mean. It follows that a teacher’s attributions and judgments of students are highly significant for their development. What if teachers treated all students as highly intelligent, gifted, and creative?

People live in vast social realities that shape how they see the world around them. For instance, Hart and Risley (1995) revealed drastic differences in early socialization for children with educated parents versus those living on social support. Children of educated parents heard three times more words directed to themselves, and educated parents systematically encouraged their children, whereas the latter discouraged their children. It is unsurprising that the former tend to develop a growth mindset and the latter a fixed mindset (Claro et al., 2016). Moreover, these realities are shaped by the social identities forced upon vulnerable social groups. Stereotypical characteristics may be positive or negative and may have little to do with fact. A stereotype can place an added burden on the student (e.g., stereotype threat), which can interfere with learning and achievement (Master et al., 2016). Notably, a student does not need to believe it to feel this burden. Teaching students under a stereotype threat about the growth mindset provides them with a new way of seeing their abilities and potential (Good et al., 2003). Mindset interventions have been especially significant for students under a stereotype threat and those with a low socioeconomic status (Sisk et al., 2018).

To conclude, it is critical to understand that mindsets are largely developed and maintained by the institutional practices of schooling, the school’s pedagogical culture, and the overall sociocultural environment. The theory of social representation provides valuable knowledge

regarding the sociocultural mediation of mindsets. School is a demanding and hectic environment, where it is easy to make quick stereotypical judgments about students' abilities. Teachers should be aware of the ways school as an institution, generates different cognitive and other categorization practices. Discrimination create maladaptive social representations shaping students' views of their capabilities. Consequently, teachers need tools to fight the fixed mindset. It is crucial to shed light on how mindsets are enacted in teachers' everyday practices of interacting with students and interpreting their daily learning.

### **Maker-pedagogy as a tool for developing a next-generation creativity-related growth mindset**

Following Vygotsky (1978), we assert that all skilled activities considered to represent intelligence, giftedness, or creativity stem from culture and tradition and are then elaborated through interaction with cultural ideas, tools, practices, communities, and networks. Intelligence, talent, and creativity are culturally mediated capabilities that grow through participating in expanding cognitive-cultural communities and networks. Humans are biologically cultural, ultra-social, and hyper collaborative in nature (Rogoff, 2003; Tomasello, 2019). Despite the prevailing digital divides, the socio-digital revolution has made such networks accessible for students in industrialized countries. A radical transformation in teaching and schooling practices is needed to realize the power of social-collaborative learning for all students.

As indicated above, teachers' implicit beliefs about intelligence and giftedness can influence their interpretation of students' behavior, learning, and achievements, which may affect their pedagogical thinking and practices of motivating students (Rissanen et al., 2018). To identify students' fixed mindsets and foster a growth mindset, teachers should cultivate a growth mindset themselves by being adaptive rather than routine experts (Hatano & Inagaki, 1992) and actively participating in developing the school's operational culture (e.g., Hildrew, 2018). Teachers with a growth mindset regard emotional processes, learning strategies, and contextual factors as the leading indicators of students' behavior, learning, and achievements and try to influence them instead of seeking explanations in fixed abilities (Boaler, 2019; Rissanen et al., 2018).

Rissanen et al. (2019) framed a growth-mindset pedagogy according to process-focused pedagogical thinking, the promotion of a mastery

orientation in classrooms, and allowing challenges and creative ideas to flourish in classrooms (Kuusisto et al., 2017). This means emphasizing progress and learning goals over achievement and performance (i.e., formative rather than summative assessment) (Rissanen et al., 2019; Ronkainen et al., 2018). Supporting students' individual learning processes is vital. Teachers must understand the influence of psychological processes, contextual factors, and learning strategies as these may create barriers to students' motivation and learning. (e.g., Sormunen et al., 2020). Teacher with a growth mindset support students in overcoming these barriers (Rissanen et al., 2019). Such teachers are naturally optimistic about student learning and development and offer them "the gift of confidence" (Mahn & John-Steiner, 2003). Nevertheless, students' motivation is challenged by the increasing gap between their super-social and peer-supported out-of-school activity and teacher-led reproductive and individualist learning at school. Our study reveals that active socio-digital participators are increasingly disengaged and alienated by traditional school learning (Hietajärvi et al., 2020). The learning sciences focus on radically transforming prevailing educational practices by promoting knowledge-creating pedagogies that highlight collaboration in solving open-ended problems and building knowledge and artifacts to answer future challenges (Hakkarainen et al., 2004).

Technology-enhanced learning environments provide ample opportunities for organizing challenging projects and engaging students in knowledge creation; such projects are suitable for the phenomenon-based pedagogy of Finnish new curriculum (Finnish National Board of Education, 2016; Riikonen, Kangas et al., 2020). Engaging students in collaborative learning practices capitalizes on heterogeneously distributed knowledge and competence in a way typical of workplace communities. Socio-digital technologies enable transforming school places into spaces of learning; emerging digital fabrication technologies allow students to pursue challenging maker projects, sparking intellectual, technical, and aesthetic challenges (Riikonen, Seitamaa-Hakkarainen et al., 2020). Within this development, it is crucial to expand growth-mindset interventions beyond the intelligence and giftedness domains toward creativity; the ethos of future education should be that every student is a potential creator and inventor.

Dougherty (2013) highlighted the importance of cultivating students' maker mindset, which involves tolerating risks and failures and engaging in iterative experimental play to develop ideas into reality, giving learners "the full capacity, creativity, and confidence to become agents of change in their personal lives and their community" (p. 11). Teachers should

facilitate a creative growth mindset and foster students' capabilities. Creating novelty is a social-collaborative process, and engaging students in inventing and making artifacts releases their hidden social-collaborative learning powers. Tang et al. (2016) argued that a growth mindset is especially beneficial for creative activities and future creative achievements. A creativity-related growth mindset has been positively linked to greater academic risk-taking behavior and lower academic stress (Yamazaki & Kumar, 2013). Maker pedagogy engages students in iterative creative efforts and learning safely from productive failures (Sinervo et al., 2020). People who do not believe that creativity can be developed naturally see little reason to engage in creative activity or develop their skills (O'Connor et al., 2013). Consequently, we argue that the creativity-related mindset should be addressed when implementing mindset interventions in school.

### **Maker-centered co-invention projects at school**

To cultivate students' creativity-related mindset, we have organized a series of co-invention projects at ten schools in the capital area of Helsinki and rural schools (Härkki et al., 2021; Riikonen, Seitamaa-Hakkarainen et al., 2020). These projects have had an inclusive ethos, including all students, regardless of their cultural or socio-economical background or stereotypical judgments about their abilities. The projects aim to cultivate all students' creative and innovative skills together with critical thinking, collaboration, and communication (Sinervo et al., 2020). Moreover, the projects intend to provide diverse students with a sense of contribution. Students experience doing something worthwhile together, each student's efforts and accomplishments matter, and the whole team jointly achieves something that no one could have achieved alone. Each project was orchestrated by teachers representing different school subjects, including craft education, science, and visual arts.

Students were given an open-ended innovation challenge, such as designing functional and aesthetically pleasing artifacts that make daily activities easier and integrate digital (e.g., circuits or robotics) elements. Students worked on a compact but heterogeneous team across each longitudinal maker project. While traditional school learning relies on linear pedagogy, focusing on pre-established goals, content, stages, and outcomes, maker-centered learning relies on nonlinear pedagogy, involving emergent objects, stages, and unforeseen results (Härkki et al.,

2021; Riikonen, Kangas et al., 2020). It changes classroom dynamics and empowers students who may not do well in traditional school studies.

The co-invention process involved creative and critical thinking through evaluating ideas, defining constraints, making models, and testing the prototypes. Periodically, the teams presented their ideas and plan to the whole class and received peer feedback. The prime ideation and prototype of the co-invention were made, and subsequently the students developed the prototype further. Through the several cycles of ideation and making phases, students learned the iterative nature of the creative process and learning: they could improve their design ideas, learn from their mistakes, and develop their ideas further. These aspects align with the growth-mindset pedagogy, where learning is seen as progress, and mistakes and failures are critical for learning. Moreover, it was significant for students to share their designs with parents and a broader audience. It was an empowering experience for students to finalize their long-term process, and they were proud of their achievements (Sinervo et al., 2020).

In one invention project, the 13 student mixed-ability teams (mainstream students and special educational needs [SEN] students) came up with a wide variety of co-inventions (Sinervo et al., 2020). The teams' co-inventions focused on three primary purposes: 1) improving cleanliness, 2) providing reminders, or 3) addressing well-being (hygiene, health, and nutrition issues). Some highly original solutions for known problems were found, including vacuuming the carpet and a gel comb for styling hair, although the teams could not construct fully functional solutions. On the gel comb team (three SEN and two mainstream students), the innovation was a driving force for all students, and they were engaged in and committed to their co-invention: they made five different prototypes from wood, recycled materials, and Three Dimensional (3D) printing. The team put considerable effort into making the gel come out of the comb but encountered unsolvable problems with fluid dynamics. Committing factors for the SEN students on the gel comb team included adequate task differentiation, necessary support, and a sense of contribution. All of the SEN students felt that the malfunctioning invention was a success: "We made a prototype at least, and we did our best."

According to the SEN students' interviews, it provided a sense of contribution to something worthwhile. One of the students with severe SEN, who was in charge of drawing, stated, "I am good at drawing," His role was agreed upon with other team members. It also provided experiences of the maker mindset in terms of a persistent attitude, tireless working, and valuing all contributions. The need for teacher

support was evident in providing SEN students with an exact role on the team. From the SEN students' perspective, the co-invention project improved their attitudes towards collaborative tasks. As Sormunen et al. (2020) discovered, working as full members of a group can promote SEN students' social acceptance by peers and promote inclusion. It can also develop students' growth mindset, as it provides opportunities to learn about their strengths, agency, and empowering learning experiences. In this open-ended co-invention project, students could practice and learn a variety of things, from design to collaboration and, primarily, how to engage in long-term working without a structured and detailed lesson plan. Our experiences indicate that participation in creative technology use fosters students' construction of personal and collaborative agency and identity as a knowledge creator (Paavola, Lipponen & Hakkarainen, 2004). The co-invention projects show that treating all young people as "super talented" without stereotypical labeling is critical for advancement. People treated in this way may, miraculously, start pursuing ideas and making positive contributions to their team.

### **Concluding remarks**

The present article examined mindsets from a sociocultural perspective. We argued that, rather than mere personal dispositions, mindsets could be understood as internalized social representations mediated by prevailing social and cultural practices. Mindsets are shared between teachers, parents, and peers, although specific aspects of such social mediation warrant further study. As long as mindsets are considered to represent only individual dispositions, teachers and school leaders may not understand the critical role of pedagogic practices and a supportive school culture in facilitating a growth mindset. Thus, it is urgent to examine the social foundations of mindsets and provide schools and teachers actionable means for fostering a growth mindset (Dweck, 2017). However, more research is needed on how mindsets are enacted in teachers' everyday interactions with students and how educational institutes' operating culture affects students' mindsets.

Teachers may not be capable of eliciting a growth mindset if they do not have one. The dialogical processes of building a school's growth-mindset culture are dependent on transforming pedagogic and operational culture and developing teachers' ability to recognize students' mindsets and foster all students' development, learning, and well-being (Esses et al., 1993). Consequently, it is crucial to engage

teachers in orchestrating and conducting mindset interventions (see also Rissanen et al., 2019). When the school's operational and pedagogical culture deliberately empowers students' and teachers' growth mindsets, we may start talking about "growth-mindset school."

The rapid societal transformations related to the socio-digital revolution demand more positive perspectives on the malleability of human capabilities. Cultivating a growth mindset in the domain of creativity, beyond intelligence and giftedness, is critical. To make mindset interventions more impactful, the social nature of mindsets should be considered by transforming the prevailing individualist and acquisition-oriented educational practices and promoting social-collaborative learning and knowledge creation (Paavola & Hakkarainen, 2014). To prepare young generations for societal changes and capitalize on the novel pedagogical possibilities of digitalization, educational institutions and teachers must cultivate a growth mindset across intelligence, giftedness, and creativity in collaboration with rigorous academic research. Accordingly, educational institutions should engage students in structured creative maker practices using socio-digital technologies. Such practices allow students to experience agency and learning experiences in which they are super-talented innovators.

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