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Kinetic Thinking Styles: A tool for developing entrepreneurial thinking

Dimo DIMOV [a,b,*], Joseph PISTRUI [c]

[a] School of Management, University of Bath, Claverton Down, Bath, BA2 7AY, United Kingdom
[b] Reykjavik University, Iceland
[c] IE Business School, IE University, Spain

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ABSTRACT

In this paper, we introduce a set of instructional tools (Kinetic Thinking Styles framework) focused on developing entrepreneurial thinking by stimulating metacognitive awareness and fostering learning environments that are conducive to metacognition. We provide an account of the development of the framework, including its conceptual underpinnings, synthesis of a map of thinking styles that can help us understand how thinking operates in entrepreneurial situations, and the design process for the creation of an assessment tool (mirror) of one's thinking style. We illustrate how this suite of tools can be used in educational settings, including an example of a newly designed thinking tune-up course and a framework for understanding challenges for diverse learner populations.

1. Introduction

Entrepreneurship education has emerged on the premises that, as a discipline, (certain aspects of) entrepreneurship can be taught (Kuratko, 2005). Over time, the focus of what should be taught has shifted from treating entrepreneurship as a known process to approaching it as a method, highlighting the development of discovery, reasoning, and implementation skills to excel in highly uncertain environments (Neck & Greene, 2011). More recent reflections advocate focusing on entrepreneurial thinking, on the premise that entrepreneurship education should "produce (future) entrepreneurs capable of thinking, acting, and making decisions in a wide range of situations and contexts", recognizing that "when they engage in real-life entrepreneurial situations, novice entrepreneurs deal with novelty, change, uncertainty, and contingency" (Fayolle, 2018, p. 133). In this sense, entrepreneurship education is about a first-person transformation (Dimov & Pistrui, 2022).

While entrepreneurial education has long emphasized experience as a first-hand encounter with entrepreneurship, there is also a need for the learner to reflect on that experience with the aid of appropriate theories or tools (Hägg & Kurczewska, 2021). Reflective engagement with one's actions, thought processes and emotions – via deliberate prompts in the educational process – enables one to personalize and self-direct one's learning (Williams Middleton & Donnellon, 2014). Accordingly, entrepreneurship education research has focused on the development of learning activities that aim to develop the students' ability to reflect, such as written diaries (Hägg, 2021) and reflective videos (Wraae et al., 2021). Evidence suggests that reflection supports the development of entrepreneurial capability in students by increasing their perceived behavioral control (Lundmark et al., 2019).

We aim to extend this line of work by enriching the notions of action as primary experience and (reflective) thinking as secondary experience (Hägg & Kurczewska, 2021) with the notion of thinking about thinking as *tertiary* experience. In this, we build on the importance of metacognition as the awareness and regulation of how entrepreneurs think in the situations they face (Haynie et al., 2010) and on instructional insights in other disciplines (e.g., Ritchhart & Church, 2020; Schraw, 1998; Tishman et al., 1995) on how to improve metacognition. To create a depiction of how one thinks, we adopt the notion of thinking style as a form of mental self-government, capturing the distinct, preferred ways in which people use the abilities they have in engaging with the world (Sternberg, 1988). Recent work recognizes that the activity of dealing with uncertain, complex and dynamic environments can be understood through distinct thinking styles such as experiential (Norris & Epstein, 2011) and non-linear (Vance et al., 2007). There is therefore an opportunity to develop a conception of thinking styles that reflects the nature of entrepreneurial activity and to embed such conception in tools that can enhance metacognition.

In this paper, we introduce and outline the development of a suite of tools – Kinetic Thinking Styles – for helping make one's thinking style visible, fostering metacognitive awareness, and prompting self-reflection for personal development. We present a framework for understanding different styles of thinking, grounded in our own professional work as entrepreneurship scholars and educators. We then detail the development of an assessment tool that operationalizes the framework

* Corresponding author.
E-mail address: d.p.dimov@bath.ac.uk (D. DIMOV).

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and enables its personalized use in the classroom. We discuss our design journey from first prototype and validation to subsequent software development that improves functionality and enables the generation of personal reports. We illustrate the current use of the tools in educational settings, including a newly designed thinking tune-up course and a framework for understanding challenges for diverse learner populations.

Our work makes several contributions to entrepreneurship education, research, and practice. First, in the spirit of promoting entrepreneurial thinking, the Kinetic Thinking Styles framework provides insights for instructional design that can enhance metacognition by raising awareness of and improving regulation of how we think in entrepreneurial situations. In this way, we expand work on the personalization of the education process through developing the reflective capability of the learner (Hägg, 2021; Williams Middleton & Donnellon, 2014) by offering a specific operationalization of thinking style as habits that regulate what we see and what we do. Second, through their practical utility, our mirror-and-map tools can promote entrepreneurs' thinking about thinking throughout their journeys and thus enhance their learning. Finally, our work offers important implications for entrepreneurship as design science, highlighting how a focus on solving practical problems can be leveraged for broader scholarly insights.

2. Theoretical background

2.1. Entrepreneurship education and learning

Talk of entrepreneurship education implicates four constituent elements – instructor, learner, content, and method – of which learner and content are primary in the sense that it is in the light of their consideration that we can discuss and develop instructors and methods. The growth of entrepreneurship education reflects the recognition of entrepreneurship as a potent economic force (Kuratko, 2005), to be leveraged by expanding the cohort of agents educated in certain ways. The economic impact of entrepreneurship implicates both ventures as nerve centers for new economic activity and entrepreneurs as their progenitors. Such a two-sided view of entrepreneurship – as venture creation and entrepreneurial action – has been reflected in viewing entrepreneurship education as encompassing both a start-up perspective focused on venture creation and an enterprising perspective focused personal development in terms of mindset and skills (Hägg & Gabrielsson, 2019). We see certain shifts within each of these perspectives that inform what we aim to do in this paper. These shifts have re-defined how we think about content and learners in entrepreneurship education.

First, broader understanding of entrepreneurship as an open-ended, dynamic process in which the only constant might be the evolving intent of the entrepreneur (McMullen & Dimov, 2013) has directed attention to how entrepreneurs think about and decide what to do next. This highlighted the need for contingency approaches to business planning, emphasizing re-evaluation and iterative feedback (Honig, 2004). Further push away from the premises of a known process highlighted the need for developing discovery, reasoning, and implementation skills to excel in highly uncertain environments (Neck & Greene, 2011). In turn, to enable one to face uncertainty and novelty and thereby to think and act in a wide range of situations and contexts, there is a need for explicit focus on entrepreneurial thinking (Fayolle, 2018). The notion of entrepreneurial mindset (Kuratko et al., 2021) has emerged from a quest to penetrate general management paradigms (Stevenson & Jarillo, 1990) and has gained wider appeal thanks in part to discussions of discovery mindset (McGrath & MacMillan, 2000) and growth mindset (Dweck, 2007).

The second shift concerns the move from treating entrepreneurship as something taught to treating it as something learned (Williams Middleton & Donnellon, 2014). Indeed, earlier discussion of a general teaching model of entrepreneurship speak of education as something that is *provided* to certain recipients, for certain reasons, in certain ways and with certain effects (Fayolle & Gailly, 2008). In contrast, focusing on the learner and prompting their reflective engagement with the learning process enables the personalization of generic content into specific reasoning and self-directed development in pursuing entrepreneurial aspirations and navigating the entrepreneurial process (Williams Middleton & Donnellon, 2014). This entails a more elaborate conception of experience that distinguishes its action side as a source of sensory input (primary experience) and its processing (secondary experience) side as a source of understanding, with learning arising from the interplay of the two (Hägg & Kurczewska, 2021). Rather than simply throwing students into the "deep end" of doing entrepreneurial things, effective learning requires that they develop reflective abilities that can open up the deep structures of their thinking in processing primary experience (Hägg, 2021). As teachers encourage students to reflect on their experience, the language they use is instrumental for framing and directing student understanding (Lindh, 2017; Tishman et al., 1995). To this end, an impressive educational toolkit has been developed to turn students into reflective practitioners, including reflection reports and peer dialogues (Williams Middleton & Donnellon, 2014), entrepreneurial diary (Hägg, 2021), and reflective videos (Wraae et al., 2021).

We see a synthesis of these two trends in the idea of thinking about thinking. In the context of action as primary experience and its (reflective) processing as secondary experience, we could speak of the (reflective) processing of the (reflective) processing as a sort of *tertiary*[1] experience. This idea is illustrated in the Fig. 1, positioning our focus in relation to the reflective space highlighted by Hägg and Kurczewska (2021). Hägg and Kurczewska highlight the thinking associated with reflection in/on action – in this sense the object of thinking is the action itself (thinking about action). In our framing, the object of thinking is the entire space highlighted by Hägg and Kurczewska, i.e. thinking about thinking about action. This is about eliciting and reflecting on the very basis on which we reason about what to do.

We see an entrepreneur not just as a doer, but as a thinker, not only in the sense that their action is based on reasoning, but also in the sense that such reasoning itself is something that is subject to (further) reasoning. In this sense, an entrepreneur's action is not only their bodily / verbal behavior but also the thinking that underpins it to give it its distinct meaning. Indeed, what distinguishes action from mere involuntary behavior is the presence of intention behind it; and what distinguishes intention from other causes of behavior is that it is subject to rational justification, i.e. one is able to give reasons for what they intend to do and it is such reasons that give an action *entrepreneurial* meaning (Dimov et al., 2021). In addition, entrepreneurial intentions are complex in nature in that they connect more immediate steps and desired distal outcomes in a chain of possible actions (Dimov, 2021). In this sense, when talking to someone, one can say both "I am doing a customer interview" and "I am starting a new venture". What makes this specific step part of venture creation is the conceptual sense in which this step is part of an interconnected set of actions that can ultimately lead to the creation of a new venture. The mental construction of this set reflects how one's thinking defines what they see as doable and possible. Transforming one's thinking requires attunement to the first-person perspective of the learner-entrepreneur to enable self-regulation of one's effort (Dimov & Pistrui, 2022) and self-determination of the entrepreneurial process (Neck & Corbett, 2018).

The broader idea here is that how an entrepreneur engages with the situation at hand and regulates their cognitive response to it matters for the type of actions and learning that ensue. Indeed, how entrepreneurs react to informational cues – e.g. analysis of facts or holistic perception of patterns and possibilities – determines how they define and pursue opportunities (Wang & Chugh, 2014). The match between the informational structure of the situation and the way a prospective entrepreneur

[1] This idea can be fully appreciated in the light of the discussion of levels of learning in section 2.3.

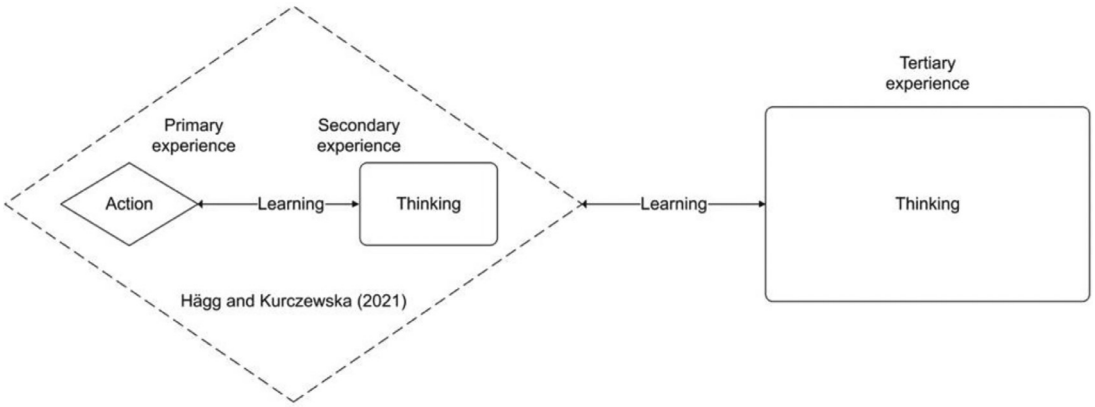

Fig. 1. Domain of the paper.

grasps and transforms experience can affect their intention to pursue an opportunity at hand (Dimov, 2007). To the extent that thinking can be seen as a skill, its development depends on the self-regulatory capability of the learner (entrepreneur), which reveals itself as "self-generated thoughts, feelings, and actions that are proactively planned and cyclically adapted to the attainment of personal entrepreneurial goals" (Winkler et al., 2021, p. 7). Winkler et al. (2021) model of self-regulated entrepreneurial learning is a cycle of three phases – forethought, performance, and self-reflection (Zimmerman & Campillo, 2003)– whereby one approaches the task in a systematic manner, engages in metacognitive monitoring and self-control in its implementations, and carefully evaluates its outcomes. Performance feedback can be utilised better when one has higher metacognitive knowledge and when the feedback relates to one's cognition (Haynie et al., 2012). This brings us to the realm of metacognition as thinking about thinking.

2.2. Metacognition

While cognitive skills are necessary to perform a task, metacognition is necessary for understanding how a given task is performed (Brown, 1987). Metacognition refers to "awareness and management of one's own thought" (Kuhn & Dean, 2004, p. 270), which entails knowledge of thinking and learning activities as well as ability to regulate them (Cross & Paris, 1988). Metacognitive regulation or monitoring is an important aspect of developing problem-solving abilities as it brings together problems and action strategies with metacognitive knowledge (including beliefs about self) and metacognitive experience of the situation at hand (Flavell, 1979). Given that entrepreneurs differ in cognitive adaptability, metacognition is an important aspect of an entrepreneurial mindset, describing "a higher-order process that reflects one's awareness and control over the knowledge structures that are employed to make assessments, judgments, or decisions" (Haynie et al., 2010, p. 220).

Metacognition is a skill and the development of its constituent parts — knowledge about cognition and regulation of cognition —has been associated with improving learning performance (Dunlosky & Metcalfe, 2009; Schraw, 1998). Metacognitive training that focuses on the connections between problems and strategy application enhances problem solving compared to direct instruction on problem solving strategies (Mevarech, 1999). Meta-analyses show large effect size for training in metacognition on the use of problem-solving strategies (Dignath & Büttner, 2008). Specific approaches that can improve metacognition include promoting metacognitive awareness, improving knowledge and regulation of cognition, and fostering environments that are conducive to metacognition (Schraw, 1998).

Metacognitive knowledge (knowledge about cognition) can be discussed in terms of the general type of knowledge it is and in terms of its specific content (i.e. what it is about). In general terms, we can distinguish *declarative* (what), *procedural* (how), and *conditional* (where and when) knowledge based on what it enables one to do (Alexander et al., 1991). These categories have been used in some classifications of metacognitive knowledge (Brown, 1987; Jacobs & Paris, 1987; Schraw & Moshman, 1995). In the specific terms of what the knowledge is about, we can distinguish person, task, and strategy (Flavell, 1979). Person or self-knowledge relates to one's beliefs about themselves as learner or thinker. Task knowledge is about understanding the nature and demands of the task at hand. Strategic knowledge is about the approaches to completing a certain task. It entails knowledge of how the approach is to be evaluated or monitors and implicates knowledge of the plans and goals for the learning process (Alexander et al., 1991).

With these distinctions, we can speak, for example, of declarative self-knowledge in terms of who I am as a thinker, procedural self-knowledge in terms of how I can use the declarative knowledge in certain cognitive processes, and conditional self-knowledge in terms of where and when can the declarative and procedural knowledge be used (Garner, 1990). Such metacognitive knowledge can help learners increase awareness of the relationship between cognition and performance, improve their understanding of cognitive strategies and habits, and become more situationally aware of the interplay between their cognition and context.

Metacognitive regulation refers to the activities that help learners control and even direct their learning. Essential regulatory skills include planning, monitoring and evaluation (Schraw & Dennison, 1994). Planning relates to the identification and selection of appropriate strategies and allocation of resources; monitoring relates to being aware of and attending to one's task performance; evaluation is about appraising how well regulation is working and revisiting one's goals (Schraw et al., 2006). For example, improved planning through raising awareness and use of effective strategies can lead to improved monitoring and enhance overall regulation (Cross & Paris, 1988). Learning performance improves with better use of attentional resources and learning strategies (Schraw, 1998). All this suggests that metacognitive regulation is a skill that can be intentionally developed to improve learning performance.

Much of the work on metacognition and its development as a skill have taken place in the context of children's education and of structured tasks such as reading and maths. In the context of entrepreneurship, one faces an uncertain, open-ended process with ill-structured tasks in which one responds to the external environment and their own motivation, and – via the metacognitive knowledge and experience they elicit – makes and regulates their cognitive responses that take the form of assessments, judgments, or decisions (Haynie et al., 2010). Conceptualizing this metacognitive process broadly as thinking about thinking, we pose questions about the specific nature of metacognitive knowledge and experience that are relevant for thinking about thinking. This relates to the perception of oneself as a thinker and the level at which one's thinking operates.

2.3. Thinking styles and levels of thinking

The brief reviews above suggest that metacognition represents a distinct ability for engaging in an entrepreneurial process. Of particular interest here is the metacognitive knowledge of self and the creation of metacognitive experience, whereby one becomes aware of how they think in certain situations. Our desire is to stimulate and enable one to think about how one thinks. This requires knowledge of different ways of thinking when engaging in entrepreneurial situation as well as tools for raising awareness of current thinking processes.

The notion of thinking style has been developed to capture the habitual ways in which people use the abilities they have in engaging with the world. In this sense, adaptation can be seen as a reflection of a repertoire of intellectual styles of engaging with the world and thus of different ways of using one's intelligence (Sternberg, 1988). Sternberg articulates an analogy with the idea that societies are governed in different way to suggests that minds can be, similarly, governed differently, thereby conceiving of how one uses their abilities as a form or style of mental self-government (Sternberg, 1988). In this sense, a thinking styles operates at the interface of ability as something evolving and personality as something habitual. Scholarly work on thinking styles has reflected this interfacial nature, with most approaches being cognition- or personality-centered (Sternberg & Grigorenko, 1997). Nevertheless, activity-centered approaches have provided distinct understanding of thinking styles as mediators of various forms of activities that may arise from aspects of cognition and personality, for example learning and teaching styles (Sternberg & Grigorenko, 1997).

Recent work has provided useful insights for understanding the nature and relevance of thinking styles associated with activities that deal with uncertain, complex and dynamic environments. Seeking to develop a measure of what they conceptualize as a counterparty to a rational thinking style, Norris and Epstein, 2011 highlight what they term experiential thinking style as having three distinct components: intuition, emotionality, and imagination. Similarly, Vance at al. (2007) recognize that thinking and problem solving in uncertain, complex, dynamic environments require going beyond linear ways of thinking. They develop a unifying conception of non-linear thinking style and discuss intuition, insight, creativity and emotion as interrelated forms of non-linear thinking. Their empirical measures show that these elements cluster along two dimensions, associated respectively with information sources and decision making.

The notion of thinking style helps us draw a distinction between the specifics of a certain way of thinking and the type of thinking it is. Categories of thinking are, in this sense, not themselves thinking but a way of making broader sense of thinking. Bateson (1972) demonstrates this notion with the example of (1) exploration as a category of behavior and (2) doing certain exploratory things (such as approaching or avoiding strange objects) as a specific item of behavior. Because the purpose of exploration (as a category of behavior) is to get information about objects (i.e., to know which are to be approached or avoided), discovering that a particular object is dangerous, in fact, represents success for exploration. Therefore, such discovery need not mean discouragement from future exploration of other strange objects. Exploration is in this sense a different logical type of behavior than approaching or avoiding an object. Therefore, learning to explore is not about the specific actions taken towards the object but about the meta-conception or the metacognitive regulation of the action.

To understand how one thinks, one needs to have a concept of the thinking activity involved, i.e. what type of thinking it is, which in turn requires one to be able to contextualize thinking. To unpack this, we draw on Bateson's (1972) framework of levels of learning that elicit a metacognitive ability to contextualize something. For Bateson, learning is a communication phenomenon in the sense that it is associated with the control of behavior (response) in response to feedback (stimulus). The type of behavior that changes through learning relates to how one thinks about their experience and thereby segments it into subsequences or "context" that the learner can deem to be the same or different. In other words, there is logical or symbolic representation of experience – a result of thinking about the experience –that is an inherent part of learning; it defines what the "stimulus" and "response" are in a given experience. In thinking about thinking, we thus need to define the elements of the thinking process that we aim to regulate.

Zero learning pertains to developing a reliable response to some repeated prompt or input. For instance, one can be prompted to apply linear thinking to a given problem, representing it as a sequence of steps to be resolved. This is about having the correct response to the repeated prompt and, as such, it is not subject to trial and error. Beyond zero learning, all learning is stochastic in the sense that it involves trial and error. Therefore, using zero learning as a base, processes of learning can be ordered on a hierarchical classification of the types of error to be corrected.

Learning I pertains to a choice from a fixed set of response alternatives: e.g., what type of thinking is to be done. This is about adapting the specificity of response based on contextual cues. One learns to evaluate the context, within which to differentiate one type of thinking from another and thereby determine, having practiced linear thinking, for example, whether linear thinking is appropriate to use in the particular context. Therefore, Learning I is about problem solving in regard to the decision of what thinking to use: one moves from (mindlessly) doing an activity A (e.g. linear thinking) to recognizing the context (problem P) in which A should be done.

Learning II in turn is related to the context of Learning I. It is about choosing the type of context or the type of problem from a broader set of alternative contexts. It becomes about the context of the context of A. At this higher level of conceptual abstraction, one looks for markers to help differentiate the context of A from other contexts. Bateson (1972) argues that what is learned in Learning II is a way of punctuating events as a way of seeing and understanding one's life and experience. A way of seeing in this sense is not true or false – it is about "seeing as" and thus not a matter of perception but of interpretation (e.g., Wittgenstein, 1958 and the discussion of the duck-rabbit picture). In this sense, Learning II is associated with habit formation, whose function is an economy of the thought processes associated with problem solving. At this level we may speak of "character" as certain habits of perception and response: ""I" am my habits of acting in context and shaping and perceiving the contexts in which I act. Selfhood is a product or aggregate of Learning II." (Bateson, 1972, p. 309). In this sense, we can think of thinking style as a Learning II construct.

Next, *Learning III* is about the context of Learning II—the context of the context of the context of A. At this level, one contextualizes the very habits that comprise Learning II, making them open to question and change. "To the degree that a man[sic] achieves Learning III, and learns to perceive and act in terms of the contexts of contexts, his "self" will take on a sort of irrelevance. The concept of "self" will no longer function as a nodal argument in the punctuation of experience" (Bateson, 1972, p. 309). For this reason, Bateson considers that Learning III is difficult and rare in human beings as it goes against the grain of the self-validating premises that arise in Learning II. What this means, for our purposes, is that the development of new styles of thinking and the ability to adapt one's style in response to the situation at hand is a difficult process that requires requisite tools. This is the focus of the next sections of the paper.

3. Kinetic thinking styles framework

Over the many years of teaching entrepreneurship, we gradually began to see our various classroom discussions and mentor sessions with entrepreneurial projects as examples of facing and responding to entrepreneurial situations, i.e., situations in which one has to make sense of new information and decide a course of action in the name of some broader purpose. Different engagement and responses to entrepreneurial situations thus became manifestations of different ways of thinking,

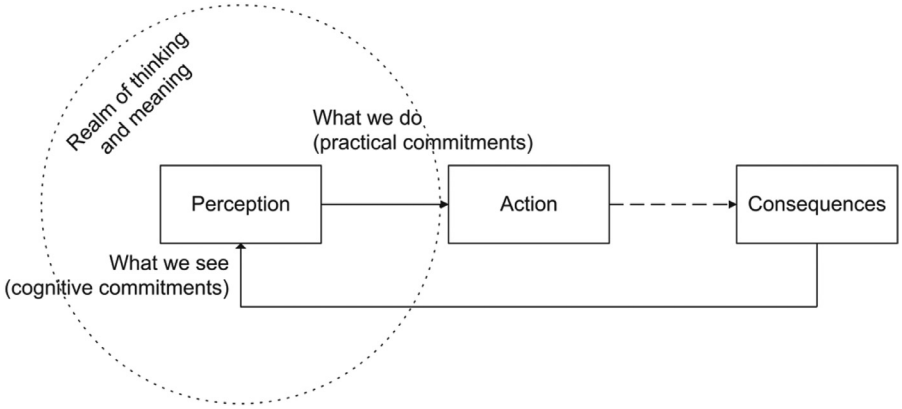

Fig. 2. Recursive model of thinking.

many of which we saw as ingrained in habits shaped by prior education and experience (e.g., engineering or art).

The desire for a framework for understanding how one thinks in a particular situation arose from an aim to situate a student or practitioner in an entrepreneurial process as an open-ended journey of evolving intent (McMullen & Dimov, 2013). Navigating this journey entails a recursive relationship of perception and action through which one deals with the uncertainty of entrepreneurial outcomes (Dimov & Pistrui, 2020; Packard et al., 2017). This is a recursive process in that it entails the continuous repetition of an idea-action-consequences loop: what one intends (the idea of what one aims to achieve) affects what one does; what one does has consequences, both anticipated and unanticipated; and these consequences affect the idea of what one aims to do (Dimov, 2017). This is the sense in which "opportunity" – as what an entrepreneur aims to make work – is an evolving blueprint for action (Dimov, 2021). It is evolving in that it responds to the consequences of prior actions, both by the entrepreneur and other actors. In this forward-looking, future-oriented sense, entrepreneurship is a design process in which the deliberation of action occurs at the interface of human intentionality and environmental constraints (Berglund et al., 2020).

To think about and thereby describe what happens at the action interface involves the use of concepts in providing an account of what one sees and what one does (Brandom, 2000). What makes such an account rational is that we can be asked for and provide reasons for the commitments we make in taking certain things as true (beliefs) and in intending to make certain things true (intentions). Perception thus "depends on reliable dispositions to respond differentially to states of affairs of various kinds by acknowledging certain sorts of commitments" (Brandom, 2000, p. 83). Similarly, action "depends on reliable dispositions to respond differentially to the acknowledging of certain sorts of commitments…by bringing about various kinds of states of affairs" (Brandom, 2000, p. 83). Therefore, as thinkers - engaged in a recursive interplay of perception and action – entrepreneurs respond to states of affairs by acknowledging certain cognitive commitments (beliefs) and to these acknowledged commitments by the practical commitments of bringing about certain states of affairs (Dimov & Pistrui, 2020). This idea is illustrated in Fig. 2, which is a simplified version of the model presented by Dimov and Pistrui (2020). Key to the model are the two arrows that define the feedback loop between the external environment and the focal thinker: what we see as the cognitive commitment one makes in taking information from the environment; and what we do as the practical commitments one makes in view of their purpose and cognitive commitments.

A style of thinking is in this sense about the combination of the reliable dispositions to respond differentially to certain states of the world and to certain cognitive commitments. In the construction of our framework, we consider such reliable dispositions as certain attitudes that one takes towards the situation at hand. The two attitudes that we define recognize two broad meanings of entrepreneurial: as seeing things differently and as doing things differently.

3.1. Attitude towards possibility in what we see

How entrepreneurs see the world is elegantly discussed by von Mises in *Human Action*: "What distinguishes the successful entrepreneur and promoter from other people is precisely the fact that he[sic] does not let himself be guided by what was and is, but arranges his affairs on the ground of his opinion about the future. He sees the past and the present as other people do; but he judges the future in a different way" (Mises, 1998, p. 485). This is about interpretative engagement with the world, whereby one judges it or sees it *as* something, in the same sense in which Wittgenstein (1958) discusses the picture as seen *as* duck or rabbit.

A shift in perception whereby the same situation is seen as something different produces surprise. This same element of surprise is present in Kirzner's (1997) discussion of sheer ignorance as what is overcome in entrepreneurial discovery: "sheer ignorance differs from imperfect information in that the discovery which reduces sheer ignorance is necessarily accompanied by the element of surprise—one had not hitherto realized one's ignorance. Entrepreneurial discovery is seen as gradually but systematically pushing back the boundaries of sheer ignorance." (Kirzner, 1997, p. 62). It should be clear that Kirzner's discovery is related to seeing as – the application of a different conceptual schema – rather than the revelation of a hidden object within a fixed conceptual schema. This aspect of Kirzner's ideas remains hidden in the lack of distinction between the world as an amorphous totality and the conceptual schema that imposes order on the world, i.e., the world as seen in a particular way.

Our conception of attitude towards possibility can be well illustrated by Steve Jobs's famous conception of the computer as "bicycle for the mind", enabling humans to rise above their cognitive limitations. In this we distinguish the tendency to see things in a settled way (within established conceptual schema) and to see them in novel ways as imaginary future possibilities. These two tendencies represent a continuum from structure (focusing on what is) to openness (focused on what is not yet). It recognizes one's power to frame and re-frame a situation but also that one can readily operate within existing frames, as implicit premises. The distinction is echoed in the differentiation that Berglund et al. (2020) make between entrepreneurship as experimentation and entrepreneurship as transformation: the former is about operating within a given, unquestioned frame; the latter is about re-framing the space for entrepreneurial action. On our continuum, focus on structure entails evaluating new information based on its relevance and fit with existing interpretative schema, while focus on openness entails looking for new possibilities and pathways in incoming information.

3.2. Attitude towards uncertainty in what we do

In regard to action, we draw upon March's (1971) distinction between technology of reason and technology of foolishness. It highlights the tension between catering to given goals and looking for new goals as logics of action. This also resonates with De Bono's (1993) distinction of judgment and movement as logics of action: the former entails pushing forward under the weight of evidence and accountability, while the latter entails jumping ahead for the sake of seeing what happens.

Depending on the reasons they can give for what they do, entrepreneurs can act without reasons, with reasons and for reasons (Brandom, 2000; Dimov & Pistrui, 2020). Acting without reasons is about doing something on impulse (Lerner et al., 2018) or simply acting for the sake of seeing what happens (De Bono, 1993). Acting with reasons relates to when one can produce reasons for what they do but they are not connected to the produced consequences. For instance, when one turns on the light in a room and thereby alerts a burglar who flees, one did not intend to alert the burglar (even if one did so), but one did have reasons for turning on the light. Acting for reasons relates to explaining action in terms of intended consequences, which in turn can provide justification for what one does.

Our conception of attitude towards uncertainty relates to the continuum between reason and play in deciding what to do. Focus on reason relates to seeking rational justification for actions, based on anticipation and evaluation of their consequences, while focus on play entails taking actions simply to probe situations and see what happens.

3.3. Kinetic thinking styles

We combine attitude towards uncertainty (with its continuum between reason and play) and attitude towards possibility (with its continuum between structure and openness) to derive a framework of *Kinetic Thinking Styles*. We chose the term 'kinetic' as a signal that, based on metacognitive awareness and reflective practice, one can rise above their 'default' style of thinking – their Learning II habits – and operate across the full range of thinking styles.

We consider the interplay between the two attitudes in the same manner as the interplay between grasping and transforming experience in experiential learning (Kolb, 1984). Thus, different combinations of the two attitudes define four elementary styles of thinking, representing distinct ways of engaging with entrepreneurial situations: focused, playful, incremental, and breakaway. The framework is shown in Fig. 3.

4. From framework to tool for enabling thinking about thinking

To turn the framework into a tool, we followed an open, iterative design process that is illustrated, in a retrospective sense in Fig. 4. The process was driven by a quest to have a useful tool in the classroom that can prompt and facilitate discussions about thinking. In terms of instructional design for metacognition (Schraw, 1998), while we had a sense of the environments that would be conducive to metacognition – e.g., individual self-reflection and small-group discussions – we needed tools for promoting metacognitive awareness and for improving knowledge and regulation of cognition.

4.1. Initial framework validation

To socialize the initial thinking style framework, we undertook a series of activities. First, we integrated a set of concepts and tools into a string of leadership development engagements with practicing managers from a range of companies representing a cross section of industries including financial services, digital media, professional services, fast moving consumer goods and social enterprise. In parallel, the thinking style framework was added to a range of postgraduate entrepreneurship courses including MBAs, Executive MBAs, and Senior Management Programs.

In all instances the framework was introduced, an overview of the two attitude continua were operationalized, and individuals were asked to "place themselves" within the two-by-two matrix based on their intuitive understanding of their own preferred style of thinking. This was then followed by reflective exercises and group discussions to further explore the concepts and their relevance to the practice of management. We also held follow-on discussions with select company sponsors and informal exchanges with delegates to screen for relevance, understanding and anticipated application to future actions. Likewise, informal student feedback was collected and more structured conversations with designated class representatives were undertaken. Collectively, this feedback was used to advance descriptions of the tools and materials and deepen understanding of the importance and potential the framework represented.

Next, during a gathering of a business school´s global alumni a short workshop was created to introduce the thinking styles framework and engage former students (and current practicing managers) in a developmental exercise. As part of this workshop, we developed and circulated a 4-color handout providing an overview of the thinking styles and a QR code directing the recipients to complete an early draft of a thinking style instrument. This generated 43 responses (out of 250 hand-outs distributed), including those who attended the workshop, which confirmed the utility and feasibility of a short instrument. Subsequently, we held discovery follow-on conversations with a convenience sample of accessible alumni to receive feedback and validate the concepts being investigated.

4.2. Assessment instrument

Encouraged by the positive reception of our framework in the various learning and development activities, we set out to personalize the use of the framework, enabling each learner to reflect on their own thinking. In other words, while learners could see the broad range of thinking styles as an indication of how it might be possible for them to think, it was necessary for them to be able to see their starting point for development. In this way, we see thinking about thinking as enabled by a mirror and map combination. Being able to see their current thinking style is akin to learners' looking in the mirror. They can then place their style on a broader map of thinking styles – our Kinetic Thinking Styles framework – and thereby determine a direction for personal development based on movement on each of the two attitude continua.

Crucially, while we used the term 'assessment tool' in describing what we set out to do, we were clear that the tool was not to be interpreted as showing stable individual characteristics (such as personality). Rather, our idea was that – once someone is made aware of their habits of thinking (as located within our framework) - they could bring this newfound self-awareness into their reflective practice and thus gradually aim to display different attitudes towards uncertainty or possibility in situations that might call for different ways of thinking. This is consistent with activity-based conceptions of thinking style (Sternberg & Grigorenko, 1997) and the logic of intervention is similar, for example, to training to eliminate unconscious bias in hiring decisions. Once someone's unconscious bias in decisions is revealed and made explicit, they can use their reflective abilities to change their decision approaches in future situations.

To develop our assessment tool for Kinetic Thinking Styles, we adopted ipsative logic – i.e. forced choice – which is suitable for capturing the dialectical nature of resolving tensions in situational responses and is thus consistent with the continuum-nature of our two dimensions. Ipsative logic has been used in instruments such as Kolb's Learning Style Inventory (Kolb & Kolb, 2013). Although forced-choice methods necessarily reduce biases like social desirability (Saville & Willson, 1991), the ipsative measures they provide, i.e. measures with the same summed scores, are sometimes seen as problematic in that their spurious negative correlations may create disturbances in statistical analyses that could impede normative comparisons across individuals

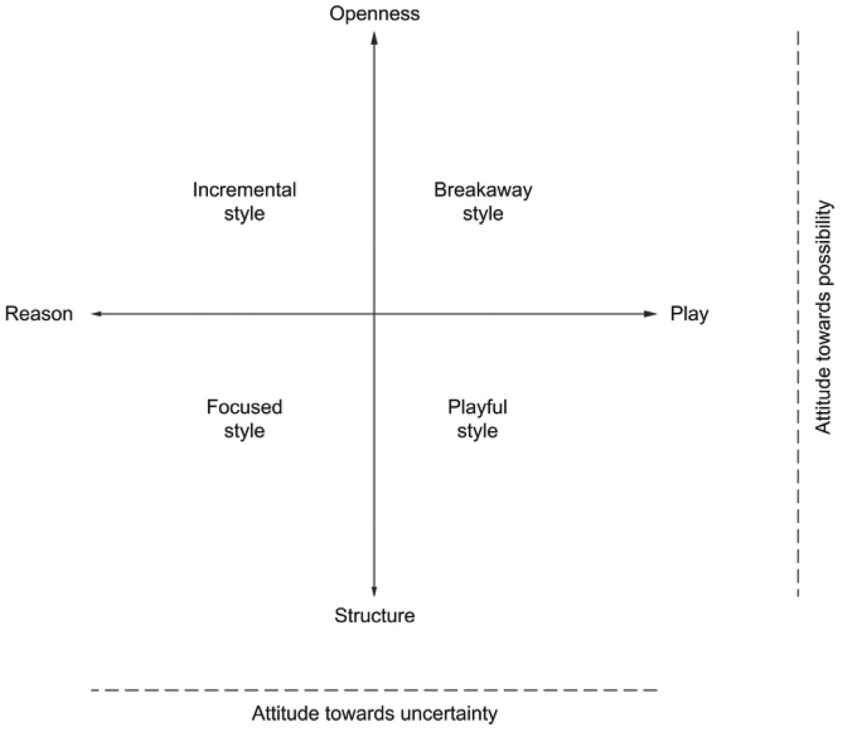

Fig. 3. Kinetic Thinking Styles Framework.

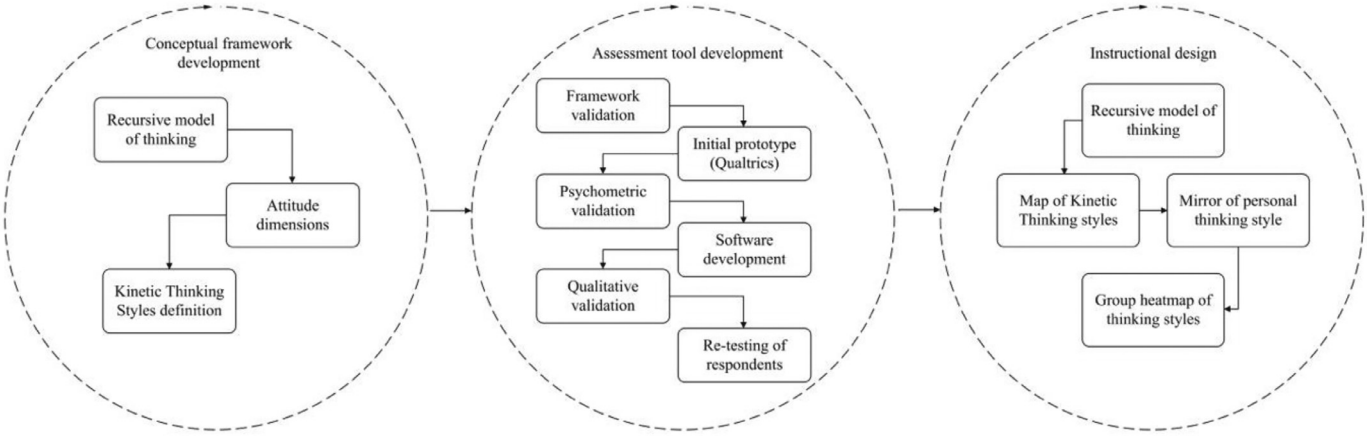

Fig. 4. Overview of design process.

(Dunlap & Cornwell, 1994). However, our main considerations were that (1) a situational response necessitated some form of forced choice and (2) ipsative instruments were most meaningfully used for qualitative comparisons (e.g., categorizing individuals) rather than statistical analyses.

To develop our measure, we started out by brainstorming 10 pairs of words that represent the contrast between reason and play in attitude towards uncertainty and 10 pairs of words that represent the contrast between structure and openness in attitude towards possibility. We gradually refined the words based on small-scale pre-testing for clarity and, after finding that single words could be ambiguous, eventually turned them into short phrases. The initial prototype instrument thus consisted of two 10-question sections, where each question represented a forced choice between two phrases. Within each dimension, the order of presentation of the phrases was randomized, which generally improves the test-retest reliability of the instrument (Veres et al., 1991).

We framed the pre-action scenario in the following way: "Think about situations in which, frustrated by problems or intrigued by new developments, you have had an insight for a new or better way. Grabbed by the new idea you … Please select the phrase that better represents what you would do next". And we framed the post-action scenario as follows: "Having done something about the new idea – whether researching it or trying it out – you are faced with new information, some positive and some negative. Still intrigued by the idea you … Please select the phrase that better represents what you would do next".

Based on the responses to the 20 questions, we created individual scores for reason, play, structure and openness from the number of times that their respective options have been selected from the presented paired choices. Thus, the scores for reason and play add up to 10 (i.e. the number of choices presented) and so do the scores for structure and openness. We also created dimensional scores for attitude towards uncertainty and attitude towards possibility, based on respectively the differences between play and reason and between openness and structure. In this way, the dimensional score represents the position on the continuum between −10 and 10 for on each dimension.

Table 1
Summary of psychometric validation.

		Attitude towards uncertainty		
		Reason		Play
Attitude towards possibility	**Openness**		Emotional stability	Openness to experience, ESE searching, ESE Marshalling Extraversion, Agreeableness
	Structure	Conscientiousness, Need for closure	ESE Implementing-people	

4.3. Psychometric validation

The instrument was initially tested with 169 students in an international MBA program at a top European business school. The Kinetic Thinking Style (KTS) assessment was carried out online (using Qualtrics), in the context of a special Start Up "Laboratory" (SUL) experience near the middle of the MBA program. All students involved in the SUL had completed a dedicated three-part entrepreneurship curriculum along with the traditional MBA courses covering accounting and finance, strategy, marketing, operations and decision-science. Specifically, the entrepreneurship curriculum covers topics ranging from ideation to exit, and include an integrated learning design that encompasses key entrepreneurial concepts and frameworks, process models, case study examples, simulations, and a litany of skills-based exercises and experiences that require students to experiment first-hand with the entrepreneurial process.

The SUL design administered the KTS assessment during the transition from the core entrepreneurship curriculum, and individual student results were used in a series of early team formation exercises where individual styles were discussed and the implications for team interactions explored. The KTS data were debriefed in a team formation workshop where the four styles were reviewed, individual scores revealed, and team style representation was considered with the support of entrepreneurship faculty facilitators. Following the team building workshop, the student teams embarked upon the five-week SUL experience.

In addition to the KTS instrument, the online assessment included a number of other personal measures selected to establish how KTS fits within a network of established individual characteristics associated with thinking, such as personality (TIPI scale, Gosling et al., 2003), preference for thinking measured by the Need for Cognition scale (Cacioppo et al., 2013), and need for closure (Kruglanski et al., 2013). We also captured demographic characteristics, namely age, gender, and native language.

Following the initial validation, we continued to use the prototype instrument with other student and executive development populations as part of class sessions that we facilitated. We sought further validation by including measures of entrepreneurial self-efficacy (ESE) using the measure developed by McGee and colleague (McGee et al., 2009). This is a multi-dimensional measure with separate scores for searching, planning, marshaling, implementing-people, and implementing-financial. At the same time, we dropped the need for cognition and need for closure measures from the online assessment due to their significant length (which had made the overall assessment excessively long). In this subsequent phase of psychometric validation, we gathered 245 observations.

The results from the various analyses we conducted are presented in the Appendix. These include summary statistics and pairwise correlations as well as regression results for the second-order measures of attitude towards uncertainty and possibility against the other variables collected in the survey. Here we highlight key insights. By design, there is perfect negative correlation (−1) between the reason and play and structure and openness scores. The second-order dimensions of attitude towards uncertainty and possibility are correlated 0.37 suggesting that these dimensions are distinct and thus have limited overlap (explaining 14% of each other's variance). Notably, there was great diversity among the participants, with all quadrants represented.

We summarize our psychometric validation insights in the Table 1 below. It shows how the various individual characteristics map onto our KTS framework. They can be related to one or both attitude dimensions and we indicate the end points of the respective continuum (e.g. reason or play, structure or openness). Personality characteristics underpin distinctions between reason and play as well as between structure and openness. Notably, conscientiousness and openness to experience map well onto our focused and breakaway styles respectively, emotional stability is associated with openness, and extraversion and agreeableness are associated with play. Need for closure maps onto structure and reason (focused style). In terms of entrepreneurial self-efficacy, searching and marshaling map onto play and openness (breakaway style), while implementation-people maps onto structure.

Overall, these results were encouraging and suggest good convergent, nomological validity for our KTS instrument. It is associated with established variables in theoretically intuitive ways and there are no theoretical inconsistencies. In addition, as the explained variance is no more than 25% in all models, the measure cannot be reduced to linear combinations of other variables. This indicates good divergent validity.

4.4. Qualitative validation

The psychometric assessment gave us confidence that the interplay that we sought to measure – between reason and play on one hand, and between structure and openness on the other – relates in predictable way to personality or other characteristics that one would expect to be implicated given the conceptualization of the two underlying dimensions. We took this as an indication that we were capturing something relevant in producing the KTS scores and plotting it on the KTS framework.

Another important form of validation of the meaning of these scores came from the class and team debriefing sessions in which learners were asked to compare and discuss their styles in groups and to reflect on their styles and professional experience. The discussions revealed not only appreciation of individual differences in thinking – which the framework made explicit and for which it provided an account in terms of the underlying attitudes – but also prompted self-reflection on how one's style reflects their personal, education, and professional experience. For instance, those with Focused styles would comment on the significance of their engineering education or finance roles, both emphasizing clear problem definitions and accountability. Similarly, someone would relate their Incremental style to their role as operations director of a manufacturing plant and thus with focus on continuous improvement.

In a specific example, two co-founders (A and D) reflected on their differences, with A having a Focused style and D a Breakaway style. They recognize that A is focused more on management – craving a degree of predictability and order – while D is more leadership oriented, setting a vision and pushing for change. D can think about what the future needs to look like, but recognizes that they need someone like A to deliver

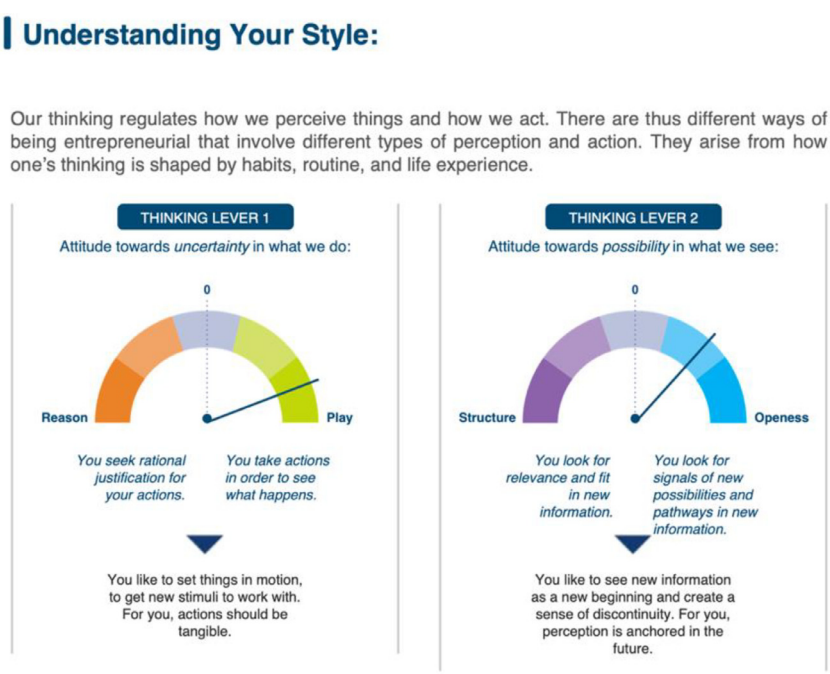

Fig. 5. Sample personal feedback on KTS.

it. There are clear strengths and weaknesses in each style. While D can sometimes get distracted and move on to the next exciting thing, not paying attention to the details, A can get bogged down with the details, needing to get everything absolutely right.

In addition to finding the KTS framework and personal style feedback very intuitive, participants also emphasize the situational nature of thinking and thereby demonstrate the very reflective abilities we seek to enable in them. For instance, in discussions of style results, some participants would explain that they took the assessment with a specific work role in mind, but that they could respond differently if they had placed themselves in a different role. Such metacognitive awareness is important as it injects into one's practice the notion that one should not engage in situations in automatic, unreflective ways but instead consider the type of thinking that may be most appropriate for the situation. In this sense, at a metacognitive level, the person chooses which thinking style to deploy. Therefore, a key effect of KTS is that it introduced a language for thinking, giving participants the ability to talk about how they think and how they could think.

4.5. Software development

The next stage in the development of the tool related to creating a customized version of the tool, not to rely any more on the standard Qualtrics survey software. There were two key functionalities missing in the Qualtrics software that we sought to address. The first related to the binary nature of the forced responses (i.e. choosing one statement over another). We wanted to have a gradated response, which captures better the notion of a continuum between reason and play and between structure and openness. We thus developed a slider with a dead point in the middle (meaning the middle cannot be chosen) and five gradated responses on each side. This effectively represents a 10-point scale to capture one's attitude position on the continuum.

The second functionality related to the ability to vary the paired phrase for each response. In Qualtrics each pair was fixed and only the left / right display of the phrases and the order of the questions could be randomized. We created a random pairing whereby a random phrase from one response set (e.g., representing reason) was paired with a random phrase from the other set (e.g., play). This means that different combinations of phrases are generated every time the assessment is administered. This functionality makes the assessment more dynamic for repeated use and also reduces the desirability bias associated with answering a fixed set of phrase pairs. This enabled us to determine whether certain phrases tend to be preferred regardless of their paired options (too strong), or whether certain phrases tended not to be preferred regardless of their paired options (too weak). Based on this analysis, we eliminated 4 strong/weak phrases from each set and thereby reduced the assessment to 12 questions (6 in each section). This meant that the assessment took less than 5 min to complete, a very attractive feature for its wider deployment.

The final aspect of software development related to the generation of a personal report. Up to that point, participants would manually plot their results and receive a debriefing of the assessment in a classroom session. The automatic generation of a personal report increased the scalability of the assessment and its value and appeal to potential participants, and created the capacity to debrief a cohort virtually. The purpose of the personal report was to provide information about the person's KTS in a way that would enable self-awareness and outline directions for personal development. The report included: (1) an overall summary and brief description of the person's KTS; (2) a summary of the scores on each dimension (uncertainty and possibility), with descriptive statements for each; (3) a benchmarking information, showing how one's style compares to others; (4) a description of all 4 styles; and (5) suggestions for personal development, termed *Kinetic Moves*. Fig. 5 below provides an illustration of the feedback related to the two dimensions of uncertainty and possibility.

4.6. Re-testing earlier respondents

After developing the custom software version of the KTS assessment, we ran a re-test with the MBA respondents who had taken the prototype version of the assessment. The re-testing took place around one year after the initial assessment. By that point, those MBA students had graduated and moved on with their careers. We reached out to them and invited them to take the assessment again, this time on the new platform. This re-testing provided an opportunity to examine not only the test-retest properties of the KTS assessment but also whether the move from the binary-choice format of the Qualtrics version to the gradated-choice of the customized version preserved the performance of the assessment.

There were 219 responses re-test in total. Fig. 6 below shows the plot of scores in the initial assessment (left) and the re-test assessment

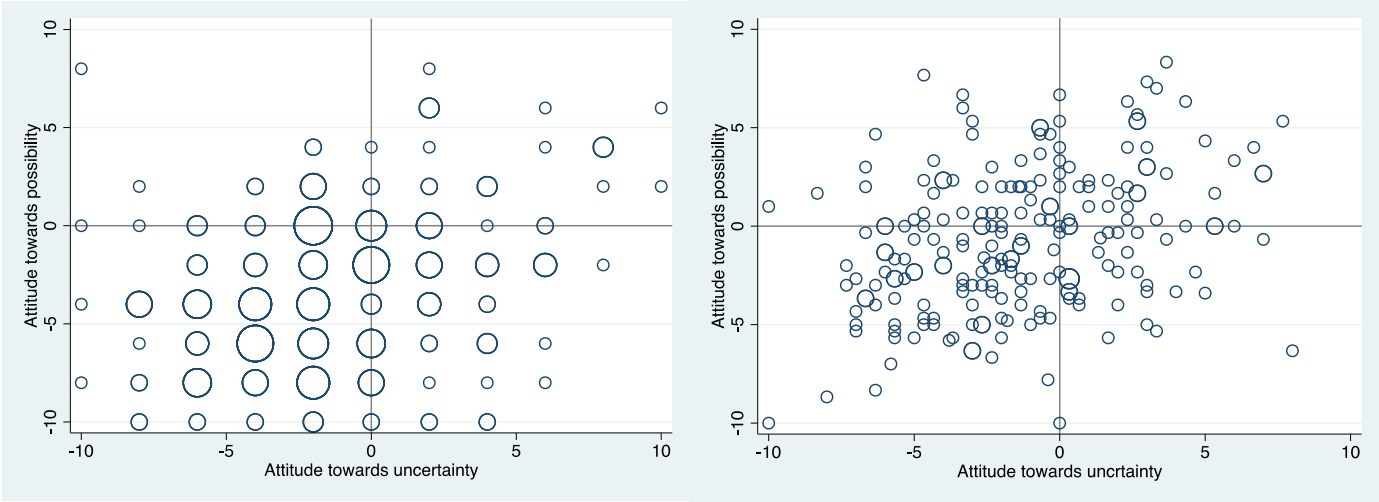

Fig. 6. Plot of scores in the initial (left) and re-test (right) assessments.

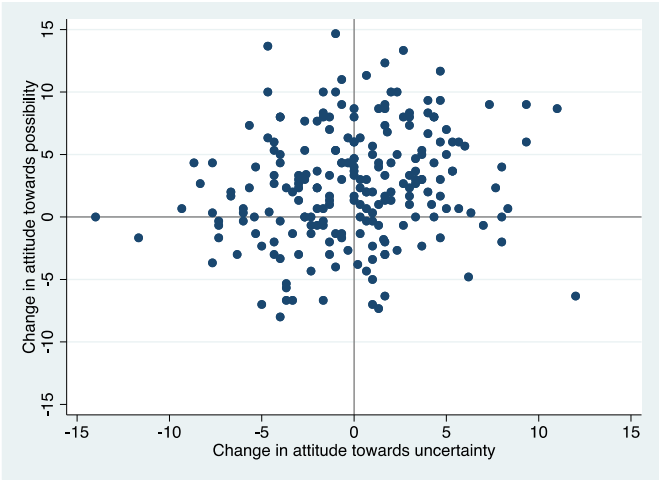

Fig. 7. Movements in the thinking style space between initial and re-test assessments.

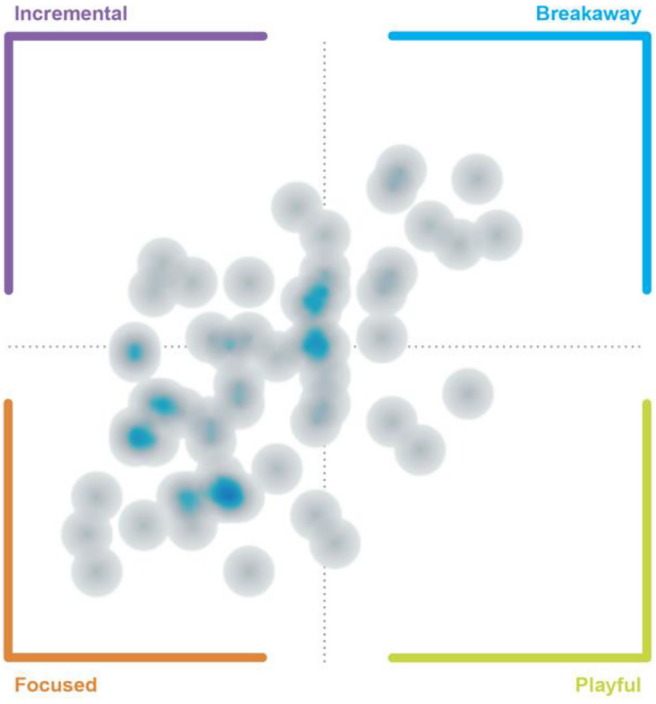

Fig. 8. Heatmap summary for group assessment results.

(right). In these plots, there is a clear difference between the discrete values resulting from the binary-choice nature of the prototype version of the assessment and the continuous scoring arising from the new version of the assessment. The new version is much appealing in its ability to capture the fluidity of movements in the thinking styles space.

To explore the shift in scores across the two assessments, we examined the differences in uncertainty and possibility scores between the two assessments. Histogram plots indicate normal distributions in both cases, with the mean for changes in attitude towards uncertainty around 0, suggesting that the split between reason and play has remained stable over time; and the mean for changes in attitude towards possibility around 2.5, suggesting that scores have shifted overall towards openness. This could be explained by the transition of the respondents from graduate education to new careers, but also by the enhanced sensitivity of the slider-based response (as opposed to a rigid, fixed choice between the extremes). By combining the changes in the two attitudes, we were able to plot the overall movement in the thinking style space, as shown in Fig. 7. It shows a balanced movement leftwards (towards reason) and rightwards (towards play). It also shows more movement upwards (towards openness) than downwards (towards structure).

Finally, we examined the correlations between the initial test and re-test scores for attitudes towards uncertainty and possibility as indicators of the stability of the assessment. For attitude towards uncertainty, the test-retest correlation was 0.43, while for attitude towards possibility it was 0.32. The average measure intra-class correlations were 0.60 and 0.41 respectively. By removing the 5 top and bottom outliers, these correlations rise to 0.55 and 0.42 respectively. And for observations within one standard deviation of the mean (66–70% of the observations), the correlations are 0.80 and 0.79 respectively. For those observations, the average measure intra-class correlations were 0.89 and 0.78 respectively.

Overall, these results indicate good continuity and stability of the KTS assessment over time and better functionality of the custom version of the assessment as a mirror of one's style of thinking. For the majority of re-test participants, there was relatively little movement in their thinking style scores. At the same time, for some participants the moves were more pronounced, perhaps reflecting more significant career changes or different roles within organizations. In line with our conception of the KTS assessment as a tool for developing new ways

Table 2
Overview of educational tools.

Tool or Artifact	Purpose	Use
KTS Matrix "map" – summary of kinetic thinking styles	Build metacognitive knowledge of thinking styles. Set the stage for metacognitive regulation.	Establish alternative thinking pathways and promote style-to-context matching. Provide a framework for planning, monitoring and evaluating style and performance.
KTSA "mirror" – personal assessment and thinking style report	Build metacognitive knowledge of thinking styles and create metacognitive experience of own thinking style.	Provide evidence of preferred thinking style.
KTSA Report & Cohort Heatmap (Fig. 8)	Build metacognitive knowledge of thinking styles and contextualize own metacognitive experience.	Provide impetus for self-reflection, peer dialog and educator debriefing of thinking style.
Recursive Model of thinking (Fig. 2)	Build metacognitive knowledge of thinking and thinking styles. Set the stage for regulation.	Establish a dynamic procedural framework where thinking style and its implications can be considered, planned, monitored, and evaluated.

of thinking, these results suggest that thinking style scores can and do change, but it is not easy (in the sense of widespread). It requires metacognitive awareness and skills.

5. Using the tool in education and development settings

5.1. Overview of instructional design

The KTS framework and associated assessment tool have become key pillars of educational design for the purpose of building metacognitive skills in an entrepreneurial context, defined as facing new (entrepreneurial) situations. The iterative development of this educational design has taken place across a wide spectrum of learners—ranging from pre-university students to the most senior executives—and among all levels of students and executives in between. Likewise, this development has occurred across geographies, nationalities, industry sectors and other measures of learner diversity expected when developing and refining robust learning tools. To date, we have received over 10,000 KTS assessment responses from our various engagements. An overview of the core KTS framework tools and artifacts is presented in Table 2.

Our typical use of the framework in a learning and development setting – whether an entrepreneurship class or an executive development session focused on developing new ways of thinking – involves inviting participants to take the KTS assessment and review their personal profiles prior to the session. In the session, we focus on the importance of thinking in framing and re-framing entrepreneurial opportunities and present the conceptual underpinnings of our model, with the two attitudes introduced as two levers of thinking that one can control. Although we are not yet able to determine the ultimate impact of our tool on the learners' daily practice, there is evidence that it does prompt deeper self-reflection and metacognitive awareness that can be embedded in daily practice. Where we use a personal reflection assignment that focuses on how new ways of thinking can be developed, we have been very impressed by the depth of the self- reflections. Here are some relevant samples that illustrate how our tools have enabled metacognitive insights.

Student 1: As for my kinetic thinking style, the assessment indicates that I am a focused thinker and I agree with it, at least partially. I am an Industrial Engineer–I believe in setting objectives, determining the best way to achieve them, and execute accordingly. I value rational thinking and structure. On the other hand, I am keen on music and other art forms–I value creativity and flexibility as well. I learned computer programming as part of my university studies. And whenever I programmed, I found that I did so in an intuitive way, rather than in a planned manner. Of course, there are rules and structures one must follow when programming, but I found it natural to experiment and iterate between different approaches to solve a problem, often pivoting between strategies. In this regard, I think moving to a playful thinking style feels natural, since both styles are based on solving a clearly defined problem.

Student 2: Not surprising to me my kinetic thinking style is focused. Sharing a background in engineering and math with my whole family only attests to the fact that I am looking for logic everywhere. My degree in psychology also pushes me in this direction–finding the reasons and motivators behind the actions of others. I, however, also try to keep an open mind and not dwell too much on analyzing the situation, which I think is why I scored not that far from the middle of the scale.

Student 3: My Kinetic Thinking Style result showed that I'm a Focused thinker. I can relate this result to my high-potential project which I didn't try to pursue. I've put a lot of thought into it and weighed all the pros and cons of it. I gathered tons of information and was in a far better position to judge the viability of the project, but still, a lot of pieces of the puzzle didn't click. For example, there was a problem with finding the right domain experts that can build this type of complex software for the Web (back in 2011). And the funding was not guaranteed, so I had to drop it. Another example of why I'm a Focused thinker is that I naturally tend to make decisions based on concrete data. Be it statistics, marketing, primary or secondary research. I like to have lots of data to use in making a decision.

5.2. Thinking tune-up bespoke elective course

In the second half of 2022 a new elective course offering based exclusively on the KTS framework was conceived, designed, and developed for a global executive MBA cohort. The pilot of the course—entitled Entrepreneurial Thinking Tune-Up—was delivered in January 2023 to 31 EMBA students who were near completion of their program. The learning experience design of the course emphasized self-development by focusing on self-awareness as metacognitive engagement, self-regulation as making deliberate choices, self-direction as taking responsibility for one´s agency, and self-determination as deciding the what and why of action. The course was positioned to students, who "elected" to join the course, as follows:

> Thinking is a pervasive element of human existence, as well as a driver of culture, technology, and creativity. Yet thinking remains mysterious and inaccessible to us because it is invisible and something we simply take for granted. In the context of business, we must understand that thinking governs what we see (our perceptions) and what we do (our actions), and forms into habits that become locked into distinct styles of thinking. Likewise, organizations and entire industries can develop dominant logics that shape perceptions of competition and notions of customer value. At the core of developing an entrepreneurial mindset is surfacing our own thinking and frames of reference, and taking control of our thinking and leveraging its power for driving imagination, creativity and innovation.

The stated learning objectives for the course indicated that upon completing the course a learner will:

1 Understand, compare, discuss and examine the role thinking plays in the entrepreneurial process.
2 Classify, map and examine different styles of thinking when facing novel entrepreneurial situations.
3 Examine, categorize and investigate the role thinking plays in how you manage and how you lead.
4 Identify, prioritize and plan for how you will become a *Kinetic Thinker*.

This elective was delivered 100% online and used a blend of learning methodologies that included both asynchronous (readings and consuming audio-visual content, carrying out exercises and deliberate learning activities, reflection, and forum discussion) and synchronous (video conferences, cohort debate, assessment debriefings and Learning Partner discussions) activities over a five-week period. The structure of the elective was a 90-minute live video conference followed by a week-long asynchronous period, repeated for a total of five consecutive weeks and 10 sessions in total.

Based on the principal underpinnings of the KTS framework, and integrating the tools and artifacts presented in Table 2, the bespoke course had as its integrating student deliverable an individual Career Reflection Essay. The essay was up to 2 pages in length and had two principal sections. The first was a self-reflective evaluation of the student´s past career and life experiences using the KTS framework, tools and artifacts as the basis for their reflection. The point here is to allow each student to deepen their understanding of self as a thinker and make sense of their own thinking trajectory by answering the question "what kind of thinking have I been up to this point in my career?"

The second section was a forward looking, speculative imagined future section where students were asked to anticipate how their thinking style will likely need to change and evolve as their future unfolds. In other words, it asked students to answer the question "what kind of thinker do I want to become in the future?"

Table 3 provides excerpts from the student work as illustrative evidence of the substance and nature of student reflection produced in this assignment.

Table 3
Student reflection essay excerpts.

Student Excerpts
Student A: . . . *When analysing the kinetic styles in more depth, I understood how much our own thinking styles are shaped through our professional journey, especially the support and environment we find ourselves in, and that all styles apply to entrepreneurial as well as corporate contexts. For example, playful and break away thinking in the identification of problems and solutions during a pre-seed stage of a startup is just as essential as playful thinking when building new services and products in an existing business.* *. . . As mentioned in one of our readings 'A Fork in the Road', it is crucial to develop a performance playbook for our business by observing the broader sector we are playing in, and ensure we are defining a clear northstar we are heading towards, to encourage creativity, curiosity and explore uncertainties, while also grounding the business in more traditional but essential financial metrics. Beyond my preferred thinking style I will need to learn how to shift between styles and adapt.* **Student B**: . . . *One of the reasons I joined EXMBA was because I wanted to develop my thinking. I felt to continue growing professionally I needed to act less in "default mode" and consider new factors, "polish" some of the thinking processes through which I analyzed opportunities. Now I am incorporating this sense of training myself to think in different ways, which many times implies stretching out of my comfort zone if the situation requires me to do so.* *. . . How do I plan to use this newly developed expanded action-field? First of all, I am already working on making it a habit to think about my own perceptions and question my assumptions. Not just at work, but increasingly in all aspects of our lives, versatility proves a critical value to face uncertainty, and I foresee this toolset will help expand my action range and with that, unlock potential beyond the edges of my default thinking.* *I remember the first assessment suggested asking more often "what is not there?" and that has stuck with me. The old pragmatical me would take whatever was available and figure things out from there, but now I feel more empowered to reframe my own thinking process. To check and recheck my own work to find those new things not-there that will return deeper insights and expand my journey of discovering.*

Table 4
Discussion forum questions.

Forum Discussion Question
Question 1: What are your "first impressions" after reviewing your personal results from the Kinetic Thinking Style Assessment?In particular discuss the following: • Were you surprised by your preferred style of thinking? ○ If yes, why? ○ If no, provide examples from your experience that reinforce your preferred style in action.
Question 2: Can you think of any recent examples where you found yourself facing circumstances where your preferred style of thinking was somehow under pressure to change or evolve? Please provide specifics (where you can) regarding how you noticed the need to change your thinking, and what exactly you did in response.
Question 3: With new information about your preferred style of thinking when you face new situations, can you see any connections to the [exercises] you completed and how your thinking style shapes how you think about opportunities? In other words, how does your preferred style of thinking affect how you see and sense opportunity?

In addition, to the assignment, other activities in the course also aimed to raise metacognitive awareness. Table 4 presents a set of questions used to animate one of the weekly discussion forums.

5.3. Wider learning applications

As stated previously, our motivation for constructing the KTS framework and assessment was driven by our desire to illuminate (make visible) how students and practitioners alike think in an open-ended entrepreneurial journey of evolving intent. As the framework developed and we began expanding the context in which it was used, we were confronted with the challenges of a wide-ranging learning community and a corresponding array of primary entrepreneurial experiences. Yet as we expanded our use of the framework we found relevance, salience, and a universal inclination to embrace the framework as a means for generating secondary and tertiary experiences to fuel the learning process.

While the traditional learner age and career stage provide a provisional learning design framing of the challenges of adapting to different learning audiences, we found it was necessary yet not sufficient for fully understanding the requisite adjustments that could be made. For example, one could face an "older" learner who does not possess either primary entrepreneurial experience or secondary reflective skills. Conversely, one could face a "younger" learner who has both high primary entrepreneurial experience and secondary reflective skills. In other words, as learning experience designers we need to move beyond age/stage assumptions and find additional ways to appeal to a full range of learners taking consideration of the Hägg and Kurczewska, 2021 learning process construct. The resulting learning through experience matrix is presented in Fig. 9. While this matrix is far from comprehensive, it provides a starting point for the learning experience design process based on two critical variables.

For example, when working with pre-university students (age 16–18) the absence of experience is a likely challenge (Learner A). As such, we use a case study to establish a shared context and serve as a proxy for the missing primary experience, putting students "in the shoes" of entrepreneurs (empathy) so they can reflect on what transpired in the experience of a third-party entrepreneur in order to allow them to experience the reflective side of building understanding through secondary experiences. This approach also has the potential knock-on effect of cultivating metacognitive and reflective skills among secondary education students (Ritchhart & Church, 2020), a way of embracing the notion of teaching thinking "to prepare students for a future of effective problem solving, thoughtful decision making, and lifelong learning" (Tishman et al., 1995, p. 1).

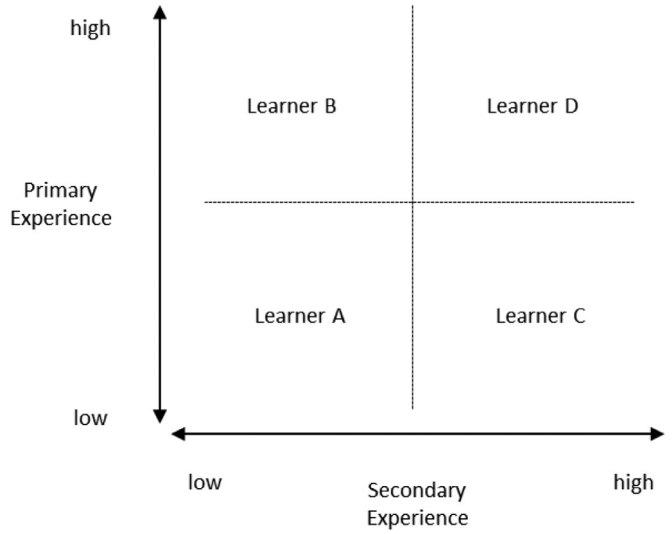

Fig. 9. Learning Through Experience Matrix.

Additionally, when working with more experienced practitioners with meaningful and/or fresh experiences (Learner B), we have often encountered a different challenge, namely Level II habits (in the language of Bateson, as discussed in Section 2.3) of interpretation can become an impediment to perceiving an ever-expanding spiral of possibilities associated with an entrepreneurial journey. In these circumstances, we can provide examples of these framing challenges from companies and industries outside their experience zones as a way to highlight the power of reframing an opportunity by shifting one's perspective. In other words, this is about thinking differently when one faces new situations.

Regardless of the learner type in question, our overarching design principle is to intentionally and systematically move the learner through three distinct steps: from step 1, where their thinking is largely invisible and habitual, to step 2 where their thinking is made visible (our mirror) and can be described (our map), and finally to step 3 when the learner can begin to take control of their thinking and experiment with prescribing their thinking style based on the circumstances they are facing at any given stage in the entrepreneurial journey. In so doing, we set the stage for empowering all learners to improve metacognitive knowledge and awareness, and to work toward mastering their regulation of cognition in entrepreneurial and other situations.

6. Discussion

Developing entrepreneurial thinking would enable future entrepreneurs to deal with the novelty, uncertainty, and contingency that real-life entrepreneurial situations bring (Fayolle, 2018). As a first-person transformation (Dimov & Pistrui, 2022), such development needs to be prompted within the perspective of the individual learner (Williams Middleton & Donnellon, 2014), providing a reflective structure within which to process their experience of the entrepreneurial process (Hägg & Kurczewska, 2021) and a space for metacognitive awareness and development of reflective thinking abilities (Hägg, 2021). Metacognition represents an essential aspect of an entrepreneurial mindset (Haynie et al., 2010) and underpins the self-regulatory capability that helps transform entrepreneurs' experience into expertise (Winkler et al., 2021). Our aim in this paper has been to advance entrepreneurship education, research, and practice by developing a set of instructional tools (Kinetic Thinking Styles framework) that can stimulate metacognitive awareness, improve knowledge and regulation of one's cognition, and help foster learning environments that are conducive to metacognition.

We provide an account of the development of the framework, including its conceptual underpinnings, synthesis of a map of thinking styles that can help us understand how thinking operates in entrepreneurial situations, and the design process for the creation of an assessment tool (mirror) of one's thinking style, from an early prototype to subsequent customized software solution with personal report. We illustrate how this suite of tools can be used in educational settings, including an example of a newly designed thinking tune-up course. We also consider the implications for using the KTS framework across a diverse population of learners and suggest a starting point for customizing learning experiences. Our practical focus drove us to develop a framework that is simple (but not simplistic) and intuitive. In addition, our vision has been to have a simple assessment tool – something that takes less than 5 min to complete, akin to reaching for a mirror in a bag to check on one's appearance – that can become a keystone of metacognitive awareness.

Our work is an example of a design science approach to entrepreneurship, in which the aim is not to develop or test new theory but to improve the art and skill of entrepreneurial practice. The materials we have created constitute artifacts that can make a difference in how we teach and what we do. We have been motivated by a clear practical problem, namely how to enhance metacognition in the learners we encounter, i.e. enable them to think about how they think. We recognize that those stepping into an undergraduate classroom or executive development session bring with them certain settled ways of thinking and preconceptions about entrepreneurship (Dimov, 2017). The scientific grounding of our work comes from conceptual synthesis of insights form entrepreneurship education, entrepreneurial learning, metacognition, and thinking styles. At the same time, the practical utility is ultimately determined by whether its users would find it engaging, stimulating, and insightful.

6.1. Contributions

Our work makes several contributions to entrepreneurship education, research and practice. First, we advance conversations in entrepreneurship education that place emphasis on the learner in terms of how they convert their first-hand experience of the entrepreneurial process into personal understanding of their values, motives, strengths and weakness in relation to entrepreneurial action (Williams Middleton & Donnellon, 2014) and of how they use reflective thinking to develop entrepreneurial knowledge (Hägg & Kurczewska, 2021). This line of work has advanced instructional design in entrepreneurship education by outlining how reflective thinking and metacognitive awareness can be stimulated and developed throughout the educational journey to create self-regulated learning (Hägg, 2021). Stimulated by this work, we zoom out the metacognitive lens to focus on the very process of thinking, providing a framework (language) for its interpretation and a tool for its illumination.

In our experience across the full range of learners – from undergraduate courses in entrepreneurship to executive development sessions motivated by a desire to make large organizations more entrepreneurial – we became aware that certain habits of thinking stood in the way of appreciation of the open-ended nature of entrepreneurial journeys. For those transitioning into higher education, these habits related to the need for structure and clarity for what constitutes "good" work. For those stepping out of the fray of corporate life, the habits related to thinking through the categories of efficiency and short-term results. In both cases, we sought to create a detachment from the immediacy of action to focus on the thinking processes that give it meaning. By making thinking visible and providing a language to describe it, our work enables new layers of reflective thinking and metacognitive awareness of the nature and developmental potential of one's thinking style. Our framework enables the educator to see classroom participants as independent thinkers, whose thinking habits can be developed in new directions. This is an important stepping stone towards self-determined learning (Neck & Corbett, 2018) and first-person transformation (Dimov & Pistrui, 2022). In this sense, we help expand our focus as educators

from questions about the level of acquired skills to questions of how such skills are used over time, as a reflection of one's thinking style.

Second, our work contributes to research on entrepreneurial learning by offering practical ways to think about metacognition in entrepreneurial settings, in the form of thinking styles for entrepreneurship. Recent work has highlighted the importance of metacognition for the judgments and decisions inherent in the entrepreneurial process (Haynie et al., 2010) and for the entrepreneur's broader ability to self-regulate their experience (Winkler et al., 2021). We extend this work by directing metacognitive awareness to habits of thinking that regulate what we see and what we do. Our conception of thinking style brings us closer to the recursive nature of entrepreneurial activity as a cycle of perception and action and can thereby enable new theorizing and empirical study of entrepreneurial thinking and its metacognitive regulation.

Third, our suite of tools can be readily disseminated in entrepreneurial practice and provide new ways for entrepreneurship educators to engage with the entrepreneurial community in a quest to improve its art and skill. Our mirror-and-map tools have practical utility that can help promote entrepreneurs' thinking about thinking throughout their journeys and thus enhance their learning. The possibilities for such wider reach into entrepreneurial practice have motivated our design process, particularly the need to have an accessible and easy to complete (less than 5 min) assessment tool and the provision of a personal profile.

Finally, our work contributes to the development of entrepreneurship as design science. Our journey highlights how a focus on solving practical problems can be leveraged for broader scholarly insights. This occurred both through search for scientific underpinning of some of our early hunches and through the use of our tool as a new research instrument. In addition, the outputs of our work add to the arsenal of artifacts for entrepreneurial practice (Berglund & Glaser, 2022) and thereby make the entrepreneur (through their ways of thinking) a part of what is being designed in the entrepreneurial journey. In this sense, the designer becomes endogenous to the design process.

6.2. Implications for education and learning

Our work has important implications for education and learning. Our framework introduces a specific language to describe and discuss thinking as a situational activity. In this way, it creates shared meaning, through which we can not only understand differences between people but also facilitate alignment in their thinking activities as they collaborate. Inviting people to be playful or focused, incremental or breakaway communicates a certain way of engaging with the situation at hand, whether to structure information and deliberate options or to engage in provocation or unconstrained imagination.

In the most practical sense, administering the KTS assessment in an educational setting, and conducting the corresponding debriefing process, introduces students to their thinking selves – perhaps for the first time. And in certain ways, it also reveals their Level II learning habits which have been cumulatively formed over time. When observing the content and tone of student self-reflections during this initial self-discovery – when students provide poignant details from their past and current practice – it is apparent that most value the process of validating themselves as a thinker.

While this self-discovery step is important in and of itself, perhaps more important is the accompanying self-reflective activities and peer dialog where students have the chance – which many readily take – to raise Level III questions of self and begin to imagine concrete pathways for change in the form of kinetic moves among the thinking styles. It is the possibility to help individual students break through this barrier and enter into Level III thinking that makes the KTS framework so promising. While it's too early to measure the lasting impact of such a step, the early evidence is indeed exciting.

Future educational design can focus on the how classroom excitement and insights can be translated into meaningful changes in daily practice. Indeed, once they return to the grind of organizational processes, thinking and self-reflection become frivolous luxuries. We should consider how to raise awareness of the importance of setting time aside for thinking and self-reflection and to dispel the ingrained behaviorist impression that, when thinking, one is not really doing anything (useful).

In conclusion, entrepreneurs take on the world as agents of change, looking to make certain impact. The world is visible in front of them and their visions for the world are visible in their minds. What is not visible is their thinking behind what they see and what they do. We hope our work provides a step towards making thinking visible.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix

Table of descriptive statistics and bivariate correlations of the variables used in the psychometric validation. Significant correlations ($p < .05$) are highlighted.

	Variable	N	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12
1	Reason	414	5.4	2.1	1.00											
2	Play	414	4.6	2.1	**−1.00**	1.00										
3	Structure	414	7.0	1.9	0.37	−0.37	1.00									
4	Openness	414	3.0	1.9	−0.37	0.37	**−1.00**	1.00								
5	Attitude towards uncertainty	414	−0.7	4.1	−1.00	1.00	−0.37	0.37	1.00							
6	Attitude towards possibility	414	−4.0	3.8	−0.37	0.37	−1.00	1.00	**0.37**	1.00						
7	Extraversion	414	4.9	1.3	−0.19	**0.19**	−0.10	0.10	0.19	0.10	1.00					
8	Agreeableness	414	4.6	1.1	−0.10	0.10	0.03	−0.03	0.10	−0.03	0.12	1.00				
9	Conscientiousness	414	5.6	1.2	0.14	−0.14	**0.22**	−0.22	−0.14	−0.22	0.01	0.17	1.00			
10	Emotional stability	414	5.1	1.2	−0.05	0.05	−0.07	0.07	0.05	0.07	0.03	0.23	0.31	1.00		
11	Openness to experience	414	5.6	1.1	−0.28	**0.28**	−0.17	**0.17**	0.28	0.17	0.33	0.11	0.13	0.10	1.00	
12	Need for cognition	169	3.8	0.4	−0.04	0.04	−0.09	0.09	0.04	0.09	0.17	0.00	0.15	0.07	0.20	1.00
13	Need for closure	169	3.5	0.4	**0.32**	−0.32	**0.32**	−0.32	−0.32	−0.32	−0.16	0.03	0.34	0.08	−0.24	−0.22
14	ESE - searching	245	3.9	0.7	−0.27	**0.27**	−0.19	**0.19**	0.27	0.19	0.14	−0.02	0.09	0.03	0.35	.
15	ESE - planning	245	3.4	0.7	−0.04	0.04	−0.11	0.11	0.04	0.11	0.08	−0.06	0.11	0.11	0.07	.
16	ESE - marshaling	245	3.8	0.7	−0.20	**0.20**	−0.15	**0.15**	0.20	0.15	0.31	0.04	0.15	0.13	0.27	.
17	ESE - implementing-people	245	4.0	0.5	−0.18	**0.18**	0.00	0.00	0.18	0.00	0.28	0.17	0.30	0.35	0.33	.
18	ESE - implementing-financial	245	3.1	1.0	0.02	−0.02	−0.02	0.02	−0.02	0.02	0.04	0.02	0.04	0.18	−0.04	.
19	Gender	414	1.4	0.5	0.22	−0.22	0.25	−0.25	−0.22	−0.25	0.02	0.10	0.09	−0.16	−0.07	0.06
20	Age	414	2.0	0.6	−0.08	0.08	−0.02	0.02	0.08	0.02	0.08	0.17	0.04	0.08	−0.01	0.15

(continued on next page)

	Variable	13	14	15	16	17	18	19
1	Reason							
2	Play							
3	Structure							
4	Openness							
5	Attitude towards uncertainty							
6	Attitude towards possibility							
7	Extraversion							
8	Agreeableness							
9	Conscientiousness							
10	Emotional stability							
11	Openness to experience							
12	Need for cognition							
13	Need for closure	1.00						
14	ESE - searching	.	1.00					
15	ESE - planning	.	0.47	1.00				
16	ESE - marshaling	.	0.54	0.48	1.00			
17	ESE - implementing-people	.	0.33	0.32	0.44	1.00		
18	ESE - implementing-financial	.	0.07	0.42	0.12	0.15	1.00	
19	Gender	−0.16	−0.15	−0.18	−0.16	−0.19	−0.19	1.00
20	Age	0.04	−0.04	−0.08	−0.05	0.10	0.08	−0.13

Table of regression results for uncertainty and possibility across the different phases of the psychometric validation.

Note: + $p<.10$, * $p<.05$, ** $p < .01$, *** $p<.001$

	Initial phase				Subsequent phase				Combined			
	Model 1		Model 2		Model 3		Model 4		Model 5		Moel 6	
	Uncertainty		Possibility		Uncertainty		Possibility		Uncertainty		Possibility	
Extraversion	−0.02		−0.06		0.36	+	0.33	+	0.32	*	0.33	
Agreeableness	0.57	+	0.16		0.34		−0.06		0.38	*	−0.18	
Conscientiousness	−0.46		−0.28		−0.74	***	−0.95	***	−0.63	***	−0.71	***
Emotional stability	−0.17		0.06		0.22		0.64	***	0.08		0.38	*
Openness to experience	0.13		0.26		0.99	***	0.53	*	0.93	***	0.42	*
Need for cognition	0.12		0.41									
Need for closure	−2.49	***	−2.85	***								
ESE - searching					1.07	*	0.56					
ESE - planning					−0.50		0.38					
ESE - marshaling					0.24		0.22					
ESE - implementing-people					0.03		−1.23	*				
ESE - implementing-financial					−0.17		−0.24					
Gender	−1.16	+	−2.01	**	−1.43	**	−1.59	***	−1.61	***	−1.56	***
Age	−0.99		−1.16		0.37		0.17		0.24		−0.05	
Constant	11.88	*	8.84	+	−8.40	**	−2.86		−4.33	***	−2.35	
R-squared	0.16		0.17		0.25		0.25		0.17		0.15	
F	3.42	***	3.61	***	6.61	***	6.56	***	11.56	***	10.03	***
N	169		169		245		245		414		414	

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