

# ENTREPRENEURIAL EDUCATION IN PRACTICE

PART 1 - THE ENTREPRENEURIAL  
MINDSET

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## ENTREPRENEURSHIP360 THEMATIC PAPER

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# THEMATIC PAPER ON ENTREPRENEURIAL EDUCATION IN PRACTICE

PART 1

THE ENTREPRENEURIAL MINDSET



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## A COPERNICAN REVOLUTION IN ENTREPRENEURIAL EDUCATION

1. As educators and policy-makers, we all want to believe that what we do will make a difference. Bold, if plausible, claims are increasingly made that entrepreneurship education has an impact, not just on an informed intent to be an entrepreneurs but also as a life skill. We would like to think that is true. It is further claimed that the key to those deep impacts is experiential learning. We would really like to think this is true. The heart of these claims is that the leading edge entrepreneurial programmes focus less on students gaining content knowledge about entrepreneurship but instead focus more on developing the entrepreneurial mindset.

2. However, reviews of the literature purporting to assess the impact of entrepreneurship education show little evidence about the impact of deeply experiential programmes, almost never look at deep cognitive change (mindset) and are based on limited theoretical grounds.<sup>1</sup>

3. Isn't what educators are trying to do is help learners move from a more novice mindset toward a more expert mindset? This requires looking at deep cognitive change (it also requires us to validate our constructs and measures.) To achieve this we need to start by defining carefully and rigorously the dimensions of the entrepreneurial mindset. Ultimately, we then identify, test and validate measures that capture those dimensions rigorously.

4. Three key premises drive this analysis. Firstly, we assume the "entrepreneurial mindset" reflects deep cognitive phenomena, particularly deep beliefs and assumptions. Secondly, these only change through transformative learning experiences<sup>2</sup>. Thirdly, we believe that a useful way to view mindset-change is helping learners move from a more *novice* mindset toward a more *expert* mindset.

5. To assess the impacts of educational interventions it is often useful to think in terms of *outputs*, *throughputs* and *inputs*. Impact is often a combination of effects from the students, the teachers, course content, and course process<sup>3</sup>. For example, students who are eager (and able) to learn can profit greatly even if the other factors are negative. What if entrepreneurship training is perceived as highly effective simply because of highly motivated learners? On the other hand, it is even more likely that we need all the components. For example, a hostile or turbulent environment or inhibiting processes could either suppress learning or spur it, if the content, teachers and students are strong. Great content alone is unlikely to be sufficient but may be necessary. Finally, as we will see below in the role of teachers in helping novices move toward expert, having the right instructors is likely to be necessary. Again, it still comes down to this reality: Practical value for civic officials and teachers demands conceptual clarity and rigorous analysis. Champions of experiential entrepreneurship training such as the Ewing Marion Kauffman Foundation have led the call for more rigor and clarity.

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<sup>1</sup> Nor do we see much use of sophisticated research designs and methodology (Nabi, et al. 2014), let alone taking advantage of developmental psychology and cognitive neuroscience (e.g., Krueger 2007, Krueger & Welpe, 2014).

<sup>2</sup> Oversimplifying slightly, transformative learning follows the *constructivistic* model of learning that focuses on changing how we structure the knowledge we have and acquire (versus the *behavioristic* model that focuses on acquiring factual knowledge. Note, however, that deep cognitive changes are quite difficult to measure directly.

<sup>3</sup> Most research on the impact of entrepreneurship education/training is remarkably atheoretic and fails to consider all of these potential predictors/moderators.

## **Outputs:**

6. Entrepreneurship programmes love to say they no longer teach students *about* entrepreneurship, we are now teaching them to *do* entrepreneurship: An admirable but not well-defined goal. Nor have we measured actual impact. To say that we are now building the "entrepreneurial mindset" is insufficient if we cannot (or do not) be rigorous about what that term means both theoretically and empirically.

### ***Issue 1: How is “entrepreneurial mindset” defined? Can we provide a rigorous definition?***

7. Too often programmes either assume that "we will know it [mindset] when we see it" or simply assume that it is the necessary outcome from experiential learning. Very few programmes make any effort to assess mindset beyond entrepreneurial action or intent toward entrepreneurial action. In any event, it is rare to see any congruence between the definition and metrics. It is truism in education that we get what we measure or, if you prefer, it is hard to get what we are not aiming for.<sup>4</sup>

### ***Issue 2: How is “mindset” measured? Do we need to develop a protocol for assessment?***

#### ***Issue 2a: Is “entrepreneurial mindset” measured at all?***

8. Similarly, there are programmes that are hesitant to measure the mindset rigorously as they are hesitant to undergo assessment of their impact on what is an ill-defined construct. As several programmes in Europe and North America have admitted, what if the entrepreneurial mindset is rigorously defined and measured and they do not show any impact? (There is tantalizing evidence that some entrepreneurship programmes has minimal, even negative effect.) Relatively few programmes track participants over time although pre/post studies are frequent in other areas of education. No matter how seemingly transformative our pedagogies might be, apparent deep changes need not be real (or lasting). Similarly, deep positive changes need not be obvious

9. The "**HOW**": We will argue that following the constructivistic model, the best way to assess impact (regardless of objective) is to look at what has changed at a deep cognitive level, especially where behaviours may be problematic to measure. This also suggests the need for arms-length third-party assessment with a relatively formal and rigorous protocol.

#### ***Issue 2b: Are we assessing other important outcomes?***

10. It is often asserted that entrepreneurship programmes carry benefits well beyond preparing learners for an entrepreneurial career; deep experiential learning helps with life skills and other broader outcomes. Education researchers argue that these “non-cognitive”<sup>5</sup> skills have impact far beyond simply raising intent toward entrepreneurship. And why not? If the entrepreneurial mindset reflects deep cognitive phenomena then it’s the non-cognitive that drives the mindset. Very recently, the National Foundation for the Teaching Entrepreneurship (NFTE) has been testing students on an inventory of life skills and claim significant impact. While no rigorous results have been published as yet, the evidence is encouraging. Most intriguingly, Danish researchers find that more behavioristic

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<sup>4</sup> Note that many programmes like for example those in the "Global Accelerator Network" are not necessarily interested in changing mindset; rather they are selecting participants who already have a pronounced mindset. This suggests that different training programmes will have differing goals, thus differing metrics. As such, the GAN would be an ideal test bed for rigorous research with practical value.

<sup>5</sup> Ironically, the “non-cognitive” skills tend to operate a deeper cognitive level than the “cognitive” skills which are typically knowledge content.

pedagogies tend to raise intent but not the non-cognitive skills, while experiential pedagogies have the opposite effect (more on that under ‘throughputs’ below.)

**Throughputs:**

11. If we are truly going to build a more entrepreneurial mindset then we must pay close attention to both course content and course processes. Most programmes now assert that they are not focusing on learning knowledge content but instead learning how to think/act like an entrepreneur. Even if they do not assess deep cognitive change, they assume that proper “entrepreneurial” learning (usually labelled as “experiential”) is sufficient to make a difference.

12. Consider Moberg’s preliminary results from Danish high schoolers. In Denmark they assessed both cognitive and non-cognitive skills and found that teaching knowledge content raised intent and self-efficacy toward entrepreneurship while experiential learning increased non-cognitive skills. One way to interpret this is that the former raised awareness of entrepreneurship as a life option and the latter was changing the entrepreneurial mindset. Similarly, the NFTE youth program from the USA has found that their learners are improving on important life skills which are useful for entrepreneurs and non-entrepreneurs alike. If experiential learning is essential for building the mindset then we must assess that properly and skilfully.

13. Consider Table 1 below. In broad strokes, the cutting edge of education has moved from a central focus on the teacher to the teaching to the learner to (today) the learning. That is, entrepreneurship educators need to move toward what kindergarten teachers have known for a century.

**Table 1. A simplified view of how modern pedagogy has evolved**

Key theory	Core assumption	Key activity	Teaching tool example
Teacher-centred	Expert teacher and passive student	Memorisation	Fact-based lectures
Teaching-centred	Expert teacher and active student	Skill development	Teacher-directed projects
Learning-centred	Metacognitive understanding of learning	Problem-based learning	Self-managed field projects

Source: Adapted from Krueger (2007).

***Issues 3a and 3b: How experiential is the curriculum? Truly experiential vs. "hands on"***

14. This also speaks to a critical input: How good are the educators at truly experiential learning? Hands-on is simply **not** enough to induce deep cognitive change. The constructivistic model is widely-practiced among K-12 educators worldwide but bureaucratic constraints and other obstacles can be problematic. Consider physics education that is moving toward tools like peer instruction and full-on problem-based learning. For example, the work of Eric Mazur finds that peer instruction approaches appear to improve content learning and induces significant deep cognitive changes (even at Harvard). However, many programmes are highly resistant to the “flipped” classroom let alone these innovations that we take for granted in some entrepreneurship programmes. On the other hand, the very structure of many programmes such as accelerators attempt to be 100% experiential. Similarly, vocational programmes tend to be highly experiential. Finally, there is clear, growing evidence that student-led programming can be incredibly powerful and quite possibly imperative. Whether the

recent emergence of Aalto<sup>6</sup> or more established programmes like Stanford or Chalmers, these programmes would be a shadow of themselves without leadership from the learners (usually in deep partnership with the local entrepreneurial community.)

15. The "**HOW**": What are the key learning activities? Do they fit the constructivist model or are they teacher-dominated? What learning activities are rewarded? Can a school prove that they are deeply experiential? This is likely a major challenge. In a study of over 200 syllabi of purported courses on social entrepreneurship, almost all claimed to be experiential but very, very few were. Thus, it comes back to assessing deep cognitive change. Alternately, are the curriculum and its activities grounded more in generative approaches such as design thinking? Education delivered from that perspective seems a welcome trend that naturally fosters the entrepreneurial mindset.<sup>7</sup>

16. It also appears clear that highly experiential entrepreneurship programmes are remarkably embedded, even immersed in the local entrepreneurial community ('entrepreneurial ecosystem'<sup>8</sup>). That immersion facilitates deep entrepreneurial learning on multiple fronts. Moreover, the best programmes exhibit co-immersion, that is, the entrepreneurial community is embedded in the programme. Strong evidence of co-immersion is a powerful marker of great programmes. We see this in all of the 26 OECD showcase programmes identified by Entrepreneurship360.

#### ***Issues 4: Does the organisational setting impede or support experiential learning?***

17. Issue overlaps considerably with Issues 3a and 3b but raises questions such as which settings are beneficial and whether this support be generalised to types of programmes (e.g., primary, secondary, vocational, inside or outside formal education institutions)? However, it would seem highly plausible that great entrepreneurial learning is fostered by a less 'ivory tower' organisational setting. At the university level, there is much anecdotal evidence that deeply experiential entrepreneurship programmes can be handicapped severely by unfriendly institutional 'homes'<sup>9</sup>. We certainly observe from the 26 showcase programmes that primary, secondary and VET were facilitated by experiential-friendly 'homes' that embraced innovative teaching and welcomed co-immersion.

#### **Inputs:**

18. The skills and experience of educators does matter. However, programmes like the new Coneect model suggest that relatively novice educators can quickly improve as experiential educators if they do not need to unlearn old models. However, unlearning is problematic for many who are experienced. (Coneect attendees appear to perceive their own institutional settings as presenting barriers to adopting a different perspective.) In early childhood education training there is an explicit effort to induce the constructivist model immediately to maximise delivery of learning that is developmentally appropriate (a strong belief set on developmental appropriateness is unsurprisingly predictive of best practices). As such, this argues strongly that significant expertise at experiential

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<sup>6</sup> e.g., Bjorklund & Krueger (2015) show how a new program that is led by students in partnership with the entrepreneurial community can yield great results in a very short time.

<sup>7</sup> I'm indebted to Andrew and Kathryn Penaluna and their great work for this insight. See their thematic paper for a detailed, persuasive discussion.

<sup>8</sup> Please see the thematic papers by Helena Sagar and by Olivier Toutain & Sabine Mueller for more discussion. Also see the proceedings of the OECD workshop on entrepreneurial ecosystems (2013).

<sup>9</sup> I'm indebted to Martin Lackeus for this insight, shared at the 2014 OECD Entrepreneurship360 seminar. His thematic paper expands powerfully on the issues raised here.)

learning is more critical than even prior entrepreneurial experience. Moreover, strong engagement (especially co-immersion) with the local entrepreneurial ecosystem is another critical prerequisite.

***Issue 5: How skilled/experienced are the instructors?***

***Issue 5a: Do they need to share the entrepreneurial mindset (or deeply understand it)?***

19. We have touched on this already: The instructors need to be skilled at experiential learning. (It is the rare educator in any setting who will self-report as unable.) However, evidence from problem-based learning and peer instruction models argues that domain expertise may be important but expertise at constructivistic education is even more essential. Consider the high school that applied Steve Blank's Lean Launchpad class effectively – the students were far better at this than the instructors. However, it was equally clear that the instructors were excellent at experiential learning and in engaging the community. Consider also the 26 programmes showcased at Entrepreneurship360's Potsdam seminar, each outstanding programme was characterized not by past experience but by their professional expertise at experiential learning (and by deep engagement with their local entrepreneurial ecosystem.)

20. The "**HOW**": Why not rigorously assess the instructors' skills at experiential learning as well as testing them with the protocol for deep cognitive change? Do they have the mindset? Do they acquire it? This would be powerfully valuable knowledge for all the stakeholders of the institutions.

***Issue 6: Are learners already "entrepreneurial"?***

21. The students/learners themselves are an important element of assessment. Learners (of any age) may differ greatly on entrepreneurial mindset. For example, a recent study of Malaysian secondary students found in the pre-test that their factual understanding of entrepreneurship was weak; more importantly, they scored low on proxy measures of the mindset. Also, cultural norms mattered. (The same instrument given to European science PhD students found much wider range of scores on measures of the mindset.) Recall that accelerators often prefer to admit the highly "entrepreneurial."

22. The perceptions of students and the entrepreneurial community about processes and context may differ significantly and importantly from the perceptions of teachers and outside "experts".

**THE BACKGROUND: WHAT DO WE (THINK WE) ALREADY KNOW?)**

23. We are invoking deep, powerful theory and powerful but sensitive methodology from developmental psychology and ultimately from neuroscience. The interest in understanding the mindset has never been higher but we need to step up our game in terms of conceptual and methodological rigor. For example, simply counting behaviours can be terribly misleading and even inducing change in entrepreneurial intentions can be counterproductive.

## From Novice to Expert

24. From the widespread notoriety of Malcolm Gladwell's best-seller *Outliers*, most people are aware that the mindset of an expert in a domain differs significantly (and often surprisingly) from the mindset of a novice. Gladwell popularised the notion that it takes 10 000 hours of deliberate practice to make that transition but is less informative about what happens in that "10,000" hours. The 10 000 hours is a misnomer. One could spend 20 000 hours and never get close to expert. What kindergarten teachers have known for a century is that changing the mindset requires several key ingredients. Dan Goleman's 2013 book addresses this.<sup>10</sup> However, the 10 000 hours trope is useful in reminding us that moving from novice to expert is no easy task and not something one can do autonomously; one needs expert mentoring, peer support and personal reflection (and someone to facilitate all that). New research finds large differences in how much deliberate practice contributes to performance (and the nature of that practice). In any domain, experts think differently than novices.

25. What does happen? An expert may know more than a novice but it is rarely knowledge content that is the difference. Essentially, no amount of knowledge content (or skills) can guarantee expert mindsets. What differentiates the expert mindset is a significantly different way of looking at the world. Experts structure their domain knowledge very differently.

26. Knowledge structures are anchored on our deep beliefs that are usually well below the surface. Changing knowledge structures thus requires changing those deep beliefs, often in discontinuous fashion. In education, this is *constructivistic* learning as opposed to the traditional *behavioristic* learning model that emphasizes knowledge content (Lobler 2006; Krueger 2009, Neergaard, et al. 2013).

27. ***The HOW of Constructivism:*** Changing knowledge structure requires several necessary elements. This list is not exhaustive but every element is essential.

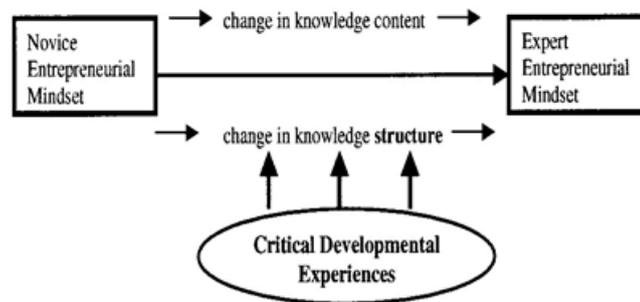
1. Authentic (important to the learner) question
2. Personal reflection
3. Peer support (often peer mentors and peer learning)
4. Expert mentoring
5. Expert facilitators of the above.

Figure 1: What changes the mindset are activities that displace its deep anchoring assumptions. We call these *critical developmental experiences* (CDE). The activity is not enough, of course; constructivistic learning uses a well-orchestrated combination of personal reflection, peer support and expert mentoring. It is very hard to learn the expert mindset without deep exposure to models of the expert mindset. (Can you become a chess master without the help of an existing chess master?)

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<sup>10</sup> Goleman, D. (2013) *Focus: The Hidden Driver of Excellence*, New York: HarperCollins.

**Figure 1. The role of critical development experiences**



Source: Krueger in this paper.

28. **The HOW:** If you are seeking to induce deep cognitive change, one mechanism for providing multiple critical developmental experiences is an approach with the deceptively simple rubric of "venture creation".<sup>11</sup> This is not students starting ventures *per se*; it is a highly structured process where we invoke all the elements of constructivistic learning and all the tools for nurturing a startup (and some that are both, such as lean startup.)

29. Since these entrepreneurship pedagogies are based almost completely on constructivistic principles<sup>12</sup> they make excellent candidates for assessing deep cognitive change. However, this begs the question of what IS this legendary "entrepreneurial mindset."

### Defining and Measuring the Mindset

30. It bears repeating that the mindset needs to be understood at a deep level: beyond behaviours, beyond intent. We do know that mindsets are malleable, especially where individuals believe that mindsets can evolve. For example, recent work by Carol Dweck has been quite instructive that mindsets reflect deep, but malleable cognitive structures that we can measure indirectly. We may not be able to measure cognitive scripts and schema directly but these deeper cognitive phenomena exhibit surface level markers and cues of their key dimensions. In fact, the deep belief that mindsets are malleable is itself a mindset (Dweck's 'growth' versus 'fixed'). But we must assess it and assess it as soundly as we can – no shortcuts – assessment must be valid, reliable and rigorous.<sup>13</sup>

31. *What might those markers be?* A review of both practitioner and academic literatures in entrepreneurship tells us surprisingly little about what comprises the entrepreneurial mindset, especially the expert entrepreneurial mindset. Some see it as reflected in entrepreneurial behaviour or perhaps entrepreneurial intentions. Others do not define it at all, let alone suggest what its dimensions might be. Too many insist that "I'll know it when I see it" but if we care about nurturing entrepreneurial potential, we need to keep digging.

<sup>11</sup> This is discussed at length in Martin Lackeus's thematic paper.

<sup>12</sup> Constructivistic principles also drive other successful entrepreneurial training (shorter-term programmes like Startup Weekend and Lean Launchpad or longer programmes like Y-Combinator and TechStars).

<sup>13</sup> Again, as championed by research leaders such as Kauffman, NESTA and the new Global Entrepreneurship Research Network.

32. If we frame the question in terms of "What would tell you that someone had the entrepreneurial mindset, especially that of an expert?" then we get several recurring themes that fortunately appear measurable.<sup>14</sup>

### *Candidate Dimensions of the Entrepreneurial Mindset*

- Action-orientation/proactiveness
- Innovativeness (presumably discontinuous)
- Resilience to adversity/optimism
- Persistence at goal-directed behaviours
- Domain-specific self-efficacy (possibly general self-efficacy)
- Role identity (mental prototypes)
- Entrepreneurial intensity
- Tolerance for ambiguity and uncertainty
- Risk-aversion (lower)
- Future orientation (ability to delay gratification?)
- Entrepreneurial behaviours (not just launching a venture)
- Entrepreneurial intentions
- Value creation (versus opportunism)
- Market orientation
- *For future analysis:* Even deeper cognitive phenomena (e.g., working memory<sup>15</sup>)

### *The Lessons of Entrepreneurial Experience?*

33. But why should teachers, school managers, policymakers, even students care? Below we go into more detail about these dimensions but the important takeaway for teachers, school managers and

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<sup>14</sup> As yet, **no** deep review of the literature has been attempted and it would be an excellent idea to conduct a full-blown structured literature review on the entrepreneurial mindset. This list provided here was crowdsourced from academics and entrepreneurs (including venture capitalists) and has been well-received at multiple conference and research seminars (such as Babson [Krueger & Neergaard 2011] and Academy of Management [2012]) and with practitioner and educator audiences.

<sup>15</sup> Cognitive complexity is another that can be tested via field experiments. Do our learners (and teachers) hold Dweck's 'growth' mindset? Do they acquire it?

policymakers is that if the entrepreneurial mindset is real and exists at a deep cognitive level (a very good assumption), then we need to identify the best markers of that mindset and assess whether training influences each market or not. Ultimately, we would map learning activities onto these markers to help identify the critical developmental experiences for each marker

34. In their powerful book, *The Lessons of Experience*, the Center for Creative Leadership identified a set of about 20 critical "lessons" that successful leaders had learned and a corresponding list of the critical developmental experiences that yielded those lessons. We are now taking the first steps to replicating this enormous effort in entrepreneurship. Why not map potential critical developmental experiences onto the facets of the entrepreneurial mindset?<sup>16</sup>

35. Each of the foregoing has significant prior support in the research literature as associated with entrepreneurial activity or closely related phenomena. As that might hint, most of these constructs have existing reliable, stable and valid measures that we are already testing on relevant populations. And while the next section speaks more to the researcher, other stakeholders can see that measuring these markers is well within our grasp.

36. Teachers, students, policymakers and administrators will also note that most of these markers are not uniquely "entrepreneurial" – they are in most cases the equivalent of "life skills". (In fact, we noted that youth educators NFTE have argued that the best takeaways from entrepreneurial training are non-cognitive skills.

- Action Orientation: The German psychologist Kuhl developed a strong scale for assessing a healthy action orientation distinct from impulsiveness. This scale has very recently taken hold in entrepreneurship (Thiel & Lomberg 2012). Pretesting has been promising.
- Innovativeness: It has been argued that entrepreneurs are more prone to discontinuous innovation so we are testing Kirton's Adaptor-Innovator scale which identifies preferences/proclivities toward incremental or discontinuous innovation. Pretesting has been disappointing here. Kirton scores have correlated with intentions and its antecedents but it thus far appears relatively unmalleable.
- Resilience to Adversity: Past research using attribution theory has been productive (e.g., the work of Kelly Shaver). We are testing here Martin Seligman's Learned Optimism that has demonstrated predictive validity in many settings. Pretesting is encouraging.
- Persistence at Goal Directed Behaviours ("Grit"): A relatively new construct, "Grit" has great appeal for entrepreneurship researchers. Grit measures the propensity to persist in the face of obstacles. It correlates, unsurprisingly, with Seligman and with the Big Five dimension of Conscientiousness.<sup>17</sup> Pretesting is very encouraging.
- Entrepreneurial Self-Efficacy: A popular construct in entrepreneurship research with as many as four established scales now available, not counting general self-efficacy which Baron argues for. Self-efficacy is a strong predictor in the intentions model, directly of perceived feasibility/perceived behaviour control and indirectly of intentions. In pretesting we have tried both the DeNoble, et al. scale (1999) and the very recent Moberg scale (2013).

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<sup>16</sup> Again, Martin Lackeus expands on this in his thematic paper.

<sup>17</sup> We pretested the Big Five personality dimensions and found entrepreneurship training did not have an impact.

37. However, some of these constructs are challenging to measure with existing quantitative mechanisms; some variables will require a more qualitative approach. Mixing quantitative and qualitative approaches will strengthen our findings, especially in the eyes of educators.

- Role Identity: Do we see ourselves truly as entrepreneurs? This would seem absolutely central to the entrepreneurial mindset and absolutely essential to the expert entrepreneurial mindset. Entrepreneurial Intensity purports to capture it (and included in the Panel Study of Entrepreneurial Dynamics, PSED) and we have used it in our prior studies. However, this is likely to be assessed more properly via qualitative approaches.

38. The "**HOW**": *Mental Prototypes*. This is a question where cognition researchers have deployed qualitative approaches. We have been testing two angles that are promising. First, there is a classic teaching exercise in entrepreneurship that asks "Draw me an entrepreneur!" Asking subjects to very quickly draw an entrepreneur before and after training tends to yield noticeable changes, usually in the desired direction (more realistic and more personalized). As this could be included as part of the training as a discussion tool, the changes could be most illuminating. There are other ways to elicit mental prototypes (e.g., fuzzy set theory and profile analysis) but they are time-consuming.

39. The "**HOW**": *Reflective Diaries*. Another time-honoured tool, we have been using the weekly reflective diaries of clients in the University of Twente's VentureLab accelerator. An expert in nVivo helped us track how the thinking of entrepreneurs evolves over time and in response to different interventions (Kaffka & Krueger, 2012, 2013, 2014). It has also allowed us to see how different types of participants evolve (e.g., novices listen more to their monthly formal reviews while non-novices listen more to customers and mentors/coaches). As some programmes already ask their students to keep a diary, this would be easy to adapt. (And it gives us potential archival data to explore.)

### **Future Markers to Test and Future Prospects for Measures**

- Risk-Aversion and Uncertainty-Aversion: The research is not terribly persuasive that entrepreneurs actually exhibit lower risk-aversion even in entrepreneurial domains. Entrepreneurial thinking should be associated more with lower uncertainty-aversion especially in entrepreneurial domains. (However, it might be useful to measure that anyway.) Measuring tolerance for ambiguity is well-established as characterizing entrepreneurs but hardly limited to them. While there is the long-used (1962) Budner scale for assessing ambiguity tolerance, there are no scales for uncertainty-aversion readily available.

40. We can, however, use field experiments to assess changes in uncertainty-avoidance based on tests of the Ellsberg Paradox (Krueger 1989; Krueger and Dickson 1994)<sup>18</sup> and the same type of items could also be used to assess risk-aversion.

- Future orientation: This is another difficult to measure construct, partly because of inconsistency of definition. However, experimental research has here too identified items that assess how much we discount future rewards. Those who are better able to defer gratification will discount future rewards less.
- Entrepreneurial intentions (entrepreneurial potential): There is considerable sentiment that the entrepreneurial mindset should be closely associated with entrepreneurial intentions,

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<sup>18</sup> Here, experimenter-induced self-efficacy overrode Kahneman & Tversky-type gain/loss framing effects and Ellsberg's uncertainty-framing effect. A strong entrepreneurial mindset would arguably have similar impacts, especially on uncertainty and ambiguity...

although it is easy to envision strong intent with a completely novice mindset (and a highly expert mindset without any current intent). For us, the expert/novice mindset tells us more about entrepreneurial potential than intent (Krueger & Brazeal 1994). As such, we include an abbreviated battery of items that capture entrepreneurial intent and its antecedents in the Theory of Planned Behaviour (Krueger, Reilly & Carsrud 2000, Krueger 1993).

- Entrepreneurial behaviours: It is important to capture past behaviours, direct and vicarious as a control variable (Krueger 1993a; Peterman & Kennedy 2003). Past experience/exposure could have an effect on deeper elements of the mindset (Krueger 1993b).

41. On the other hand, many would argue that the only way you can tell for certain that the entrepreneurial mindset exists is through action. As such, we would include the identified markers of nascency used in the PSED data set and elsewhere ("nascency" defined as taking at least one concrete step toward launch).

42. Entrepreneurial Orientation: This will be captured easily by the reflective diaries. Entrepreneurial Orientation is a firm-level measure of behavioural propensities (proactiveness, innovation, risk-acceptance – sound familiar?)

43. Entrepreneurial orientation is one but why not assess market orientation? This would seem vital to entrepreneurial thinking. An orientation toward *value creation rather than opportunism* is also important. This can be assessed from the diaries.

44. What else might we profitably assess?

- "Hot" Cognition versus "Cold" Cognition: Barbara Sahakian's Cambridge neuroscience lab published the first true neuroentrepreneurship article (in *Nature*) which showed that entrepreneurs and managers were both good at emotion-independent reasoning ('cold') but entrepreneurs were much better at emotion-dependent reasoning ('hot' cognition). Their experimental measures are lengthy to administer but could be a powerful addition to the future research agenda.
- The "Dark Side" of Entrepreneurship?: This might prove very important for policy. Most educators are mindful of the risks that such transformative learning could have unintended negatives. People who grew up in a family business score higher on the Narcissistic Personality Inventory. Future research should look at *Narcissism*, *Machiavellianism*, *Constructive Thinking* and (again) *opportunism*.
- Neuroplasticity: If we want to go really deep cognitively, there are clever tests for the size of our working memory –do entrepreneurs have more? Do they grow more? (Note that none of these measures discuss thus far require fMRI, CAT or PET scans, however, neuroimaging will eventually come into play. Consider the study of London cabbies who cannot use maps or GPS, so was it surprising that after 10-20 years the parts of their brain dealing with spatial reasoning were more developed? Like exercising a muscle... so what cognitive 'muscles' are entrepreneurs growing? Cognitive complexity? Working memory?

45. The "**HOW**": Again, field experiments are great tools for validly and reliably assessing cognitive change, especially where we can identify control groups. Control groups are often the "Achilles heel" of assessment.

46. This section speaks more to the researcher but students and teachers alike should find it encouraging that the pilot studies are highly promising. In fact, thus far my impression is that students are the most intrigued by these results, closely followed by policymakers and colleagues who are expert at experiential learning.

47. The downside is that if these markers prove valid and reliable then assessment can be highly rigorous and that means no "Lake Woebegon effect"; i.e., not every programme will be above average. In fact, some programmes will score much lower than they have advertised to their stakeholders and, worse, their process and environment may prevent them from improving. On the other hand, this is exactly why students and entrepreneurs are excited by initiatives such as Entrepreneurship360. They recognise that not all programmes are strong and that even the best programmes can improve. 48. Conceptual versions have been presented or have been accepted at Babson (Krueger & Neergaard 2011), Academy of Management workshops and symposia and to practitioner/entrepreneur groups (various 2011-2014). Also NACCE<sup>19</sup> (2011, 2013) and ECSB 3EC (2013, 2014)<sup>20</sup>. Also, chapters in *The Entrepreneurial Mind* (2009, more intentions-focused) and Zoltan Acs' *Handbook of Entrepreneurship Research* (Krueger & Day 2010, more neuroentrepreneurship) and the inaugural *Annals of Entrepreneurship Research* (Krueger & Welpel 2015). Empirical preliminary studies include:

- Freshmen and sophomore students in Malaysia (with almost zero past entrepreneurial experience or training) with Peter Koen and Heidi Bertels (Bertels, Koen & Krueger 2014, 2013 Academy of Management symposium). Supported reliabilities and the intentions model.
- European Institutes of Technology initiative to give experiential entrepreneurship training to new science/Engineering PhD students with Pasi Malinen (Krueger, Malinen & Kaffka 2014 plus ECSB papers, Academy and ICSB workshops).
- From the reflective diaries studies: Kaffka & Krueger 2012, 2014 (Babson and Academy of Management symposia 2013, 2014).

49. These presentations to the best scholars in entrepreneurship education have yielded considerable feedback that has improved every facet of this project. Moreover, it has given us a strong sense of what scholars, educators, entrepreneurs and policy makers would find persuasive (multiple settings, mixed quantitative/qualitative, etc.). As noted, we have begun to test these measures (e.g., the reflective diaries are particularly strong).

44. 50. Again, **there is nothing less than a Copernican revolution in entrepreneurial learning that is unfolding before us.** We are terribly overdue in rigorously assessing exactly what is going on. But to do that requires entrepreneurship researchers, especially on the behavioural side, who get this and have the skills, experience and contacts to do this the right way. This research will require deep, powerful theory and sensitive methodology from developmental psychology and ultimately from neuroscience. This will set the bar high for future assessment research. It will provide us a tool kit for assessing the deep impact of entrepreneurial training of all kinds. The interest in understanding the mindset has never been higher but the need to step up our game in terms of conceptual and methodological rigor has also never been higher. Shall we get started?

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<sup>19</sup> National Association for Community College Entrepreneurship; community colleges are #1 adopters of experiential pedagogies.

<sup>20</sup> Presentations slides and conference papers available from author.

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