# ENTREPRENEURIAL MINDSET ASSESSMENT REVIEWS

Reviewed by Gary Lichtenstein and Thema Monroe-White

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# 01 Entrepreneurial Self-Efficacy Scale (ESE)

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|---|---|
| **Instrument Title** | Entrepreneurial Self-Efficacy (ESE) |
| **Suggested Use, if noted** | Determining entrepreneurial tendency in college students and, possibly, those in the workforce |
| **Conceptual Framework, if any** | Bandura, Self-Efficacy |
| **Factors / constructs assessed** | ENTREPRENEURIAL SELF-EFFICACY<br>Risk-Taking<br>Innovation<br>Management<br>Financial Control<br>Marketing |
| **Reliability** | Cronbach alpha all>0.72; Total Entrepreneurial SE (one dimension)=0.89 |
| **Validity** | Items were derived using managers and entrepreneurs. |
| **Comments** | Article compares predictive validity of Locus of Control (Rotter) to Self-Efficacy (Bandura). Entrepreneurial Self-Efficacy was a better and more refined predictor (Locus of control distilled into 2 factors only). Risk-taking was most predictive of differences between entrepreneurs and managers, followed by Innovation. |
| **Availability** | C. Chen, P. Greene, A.Crick (1998) Does Entrepreneurial Self-Efficacy Distinguish Entrepreneurs from Managers? *Journal of Business Venturing* v13, 295-316 |
| **Reviewer** | Gary Lichtenstein |

# 02 EM Attitude Orientation (EAO) Scale
## Revised

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|---|---|
| **Instrument Title** | Entrepreneurial Attitude Orientation (EAO) Scale (Revised) |
| **Suggested Use, if noted** | Developing validity evidence for the EAO scale (the methodological approaches discussed can be used for other surveys). Targeted at undergrads. Sample: first year students from engineering and management courses. |
| **Conceptual Framework, if any** | Adapts and builds Robinson et al.'s EAO survey |
| **Factors / constructs assessed** | Four primary dimensions:<br>1. Achievement<br>2. Innovation<br>3. Personal control<br>4. Self-esteem |
| **Reliability** | Reliability of the EAO survey ranged from Cronbach alpha=0.7 to 0.9 across subscales and components). Confirmatory Factor Analysis (CFA) revealed poor model fit for the modified EAO instrument. |
| **Validity** | Based on CFA and EFA results the authors state that: "a complete and supportable case for the validity of this instrument in this form collectng data on this population does not exist." |
| **Comments** | Results of the exploratory factor analysis (EFA) reveal that the subscale appear to be blurring, crossing or interdependent. The article reiterates statements by Purzer that "there are significant risks in reassessing the psychometric basis, subscales, and constructs within an instrument when applying it to a new population." Furthermore the blending of the personal control and innovation subscales may be due to them both capturing a different construct such as "risk tolerance" or "risk understanding." Overall, the article stresses the difficulty of adapting instruments form one population (professional) to another (student). |
| **Availability** | Fernandez, T. M., Sliva Coutinho, G., Wilson, M. D., & Hoffmann, S. R. (2015). Development of Entrepreneurial Attitudes Assessment Instrument for Freshman Students. |
| **Reviewer** | Thema Monroe-White |

# 03 Tolerance for Ambiguity (TA) Instrument

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|---|---|
| **Instrument Title** | Tolerance for Ambiguity [TA] Instrument |
| **Suggested Use, if noted** | Tested primarily for use in cross-cultural contexts |
| **Conceptual Framework, if any** | Tolerance for ambiguity [TA] is ''the tendency to perceive ambiguous situations as desirable'' (Budner, 1962, p. 29). The author's use Budner's conceptualization and measure of TA as a foundation that they then refine. |
| **Factors / constructs assessed** | Four primary dimensions:<br>1. Valuing diverse others<br>2. Change<br>3. Challenging Perspectives<br>4. Unfamiliarity |
| **Reliability** | Pattern Matrix results revealed that each item loaded onto one and only one factor:<br>1. Valuing diverse others (alpha: 0.58)<br>2. Change (alpha: 0.51)<br>3. Challenging Perspectives (alpha: 0.56)<br>4. Unfamiliarity (alpha: 0.53)<br>Participant responses were collected on Budner's original 16 items as well as 5 newly generated items, all rated on a 5-point Likert scale anchored with 1 = ''Strongly Disagree'' to 5 = ''Strongly Agree''. |
| **Validity** | N/A |
| **Comments** | By developing a measure with improved psychometric analyses, the authors seek to establish a conceptually clear, internally consistent assessment tool. Sample: 2351 participants from multiple world regions and with varying demographic backgrounds. North America provided 56% of subjects, Asia provided 26%, and Europe provided 11%, with the remaining 7% from countries in Latin America, Africa and the Middle East. The survey was completed in English by 84% of participants, and translated/back-translated into Japanese- for the other 16%. |
| **Availability** | Herman, J. L., Stevens, M. J., Bird, A., Mendenhall, M., & Oddou, G. (2010). The tolerance for ambiguity scale: Towards a more refined measure for international management research. *International Journal of Intercultural Relations*, 34(1), 58-65. |
| **Reviewer** | Thema Monroe-White |

# 04 Curiosity and Exploration Inventory

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| **Instrument Title** | Curiosity and Exploration Inventory |
| **Suggested Use, if noted** | Not discussed. |
| **Conceptual Framework, if any** | Factors were derived from research literature on curiosity. |
| **Factors / constructs assessed** | Stretching (motivation to seek new knowledge and experiences)<br>Embracing (willingness to embrace novel, unpredictable, and uncertain situations in everyday life) |
| **Reliability** | Cronbach alpha for each scale is about 0.77; for the unidimensional measure (combined), alpha = 0.83. |
| **Validity** | Instrument was crossed with several (existing) psychometric instruments (with proven properties) assessing dimensions of emotion, including Positive & Negative Affect Schedule, Subjective Happiness Scale, Psychological Well-Being, Social Well-Being, and Emotional Distress. Criterion validity (extent to which those who score high on curiosity are, in fact, more curious) was not explored. |
| **Comments** | Curiosity is a far-ranging variable, comprised of and overlapping with several constructs. Interesting that this measure came up as a reference related to EM. It would be interesting to see correlations between this trait-like construct and various facets of EM (e.g., innovativeness, risk tolerance, etc.). |
| **Availability** | Kashdan, Todd B; Gallagher, Matthew W; Silvia, Paul J; Winterstein, Beate P; Breen, William E; Terhar, Daniel; Steger, Michael F. (2009). The curiosity and exploration inventory-II: Development, factor structure, and psychometrics. *Journal of Research in Personality,* V43, n6, pp. 987-998. |
| **Reviewer** | Gary Lichtenstein |

# 05 I-Corps™ for Learning: Entrepreneurial Performance Assessment (EPA)

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|---|---|
| **Instrument Title** | I-Corps™ for Learning: Entrepreneurial Performance Assessment (EPA) |
| **Suggested Use, if noted** | This is intended to be a team-level assessment conducted by I-Corps ™ L faculty based on their observations of teams during the course. The assessment rates the extent to which course participants demonstrate core entrepreneurial behaviors promoted in the course on a 5-point scale (1=low performing, 3=adequate, 5=high performing). The instrument is also intended to be a means of aligning instruction and continuity across faculty and courses regarding the definition of low, average, and high performance in the course. |
| **Conceptual Framework, if any** | Derived empirically through interviews with I-Corps and I-Corps L faculty. |
| **Factors / constructs assessed** | 1. Embraces Customer Discovery<br>2. Embraces the BMC<br>3, Adopts a Customer-Focused vs. Feature-Focused perspective<br>4. Strategically identifies users, buyers, and decision-makers during customer discovery<br>5. Strategically questions potential users, buyers, and decision-makers<br>6. Recognizes opportunities and is willing to pivot<br>7. Displays shared leadership; cooperative team dynamic<br>8. Displays succinct, well-targeted presentation skills |
| **Reliability** | The items on the instrument constitute a single factor that has high internal consistency, with alpha=0.91. However, faculty inter-rater reliability was poor, meaning that ratings of two or more faculty of a single team varied widely, due to the fact that faculty did not agree on what constitutes "adequate performance." Faculty calibration would be required to improve reliability. |
| **Validity** | Concepts assessed were derived from interviews and consensus-building among teaching team faculty regarding core outcomes of I-Corps L instruction. |
| **Comments** | Faculty rate each team based on a rubric (1=Low Performing; 3=Adequate Performance, 5=High Performing), which was validated by I-Corps and I-Corps L teaching teams. Instrument is course-specific and cannot be expected to generalize beyond ICL, except, perhaps, to I-Corps. Instrument is unusual in being a third-party (faculty) assessment, rather than participant self-report. |
| **Availability** | Lichtenstein, G., Simon, C., Sheppard, S.D. (2016). *I-Corps™ L External Evaluation Report: July-August 2016.* Technical report submitted on December 22, 2016. Bluff, UT: Quality Evaluation Designs. Contact Gary Lichtenstein (gary@QualityEvaluationDesigns.com). |
| **Reviewer** | Gary Lichtenstein |

# 06 The Engineering Entrepreneurship Survey

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|---|---|
| **Instrument Title** | The Engineering Entrepreneurship Survey |
| **Suggested Use, if noted** | Assessing undergraduate engineering students' (esp. seniors') attitudes towards, competence in, efficacy with, involvement with, and perceptions of faculty perceptions of entrepreneurship. |
| **Conceptual Framework, if any** | Most scales derived from a few, previously validated instruments; authors created some newly invented scales. |
| **Factors / constructs assessed** | BEHAVIORS<br>-- Extent of participation in Entrepreneurship activities<br>-- Post-graduate career plans<br>-- Intention to start a business<br>-- Type(s) of business ventures students desire to create<br><br>ATTITUDES<br>-- Extent to which E-ship is addressed in engr degree program<br>-- Student's interest in E-ship<br>-- Reasons for interest in E-ship<br>-- Reasons for not being interested in E-ship<br><br>KNOWLEDGE<br>(familiarity with E-ship related terms and concepts)<br>-- Engineering<br>-- Gen'l E-ship<br>-- Gen'l business<br>-- Marketing<br>-- Finance<br>-- Professional Skills<br><br>SELF-EFFICACY<br>-- Student's perception of technology venturing and E-ship- related abilities<br>-- Perception of E-ship related skills<br>-- Perception of E-ship ability overall<br>-- Perception of ability to start a business immediately |
| **Reliability** | Range of Cronbach alpha was 0.74 (SKILLS)-0.96 (EFFICACY and FAMILIARITY W/E-SHIP CONCEPTS & TERMS. Median C-alpha for 7 scales=0.92. |
| **Validity** | Content validity was based on prior research literature and studies, as well as a panel of 20 experts (engineering and entrepreneurship faculty, external advisory board, assessment experts). Expert perspectives were integrated throughout instrument development. Think-aloud protocols and room for comments on surveys ensured face validity. Criterion validity was assessed using experts in the field and comparing results of students who pursued entrepreneurship with those who didn't. |
| **Comments** | Note: all items are self-report. Survey is slanted toward business/tech-focused entrepreneurship; social E-ship not mentioned. |
| **Availability** | Natalie Duval-Couetil, Teri Reed-Rhoads, & Shiva Haghighi (2011). The engineering entrepreneurship survey: An assessment instrument to examine engineering student involvement in entrepreneurship education. *The Journal of Engineering Entrepreneurship*, v2, n2, pp.35-56. http://jeenonline.org/Vol2/Num2/Vol2No2P3.pdf |
| **Reviewer** | Gary Lichtenstein |

# 07 Entrepreneurial Attitude Orientation (EAO) Scale

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|---|---|
| **Instrument Title** | Entrepreneurial Attitude Orientation (EAO) Scale |
| **Suggested Use, if noted** | Assessing entrepreneurial attitudes, scale development, reliability and validity testing, survey item construction (complete scale attached). |
| **Conceptual Framework, if any** | Attitude Theory, in which there are 3 types of reaction to everything: affective, cognitive, and behavior (conation) |
| **Factors / constructs assessed** | Four attitude subscales consisting of three components (e.g., affect, cognition or conation):<br>1. *Achievement in business*, referring to concrete results associated with the start-up and growth of a business venture.<br>2. *Innovation in business*, relating to perceiving and acting upon business activities in new and unique ways.<br>3. *Perceived personal control of business outcomes*, concerning the individual's perception of control and influence over his or her business.<br>4. *Perceived self-esteem in business*, pertaining to the self-confidence and perceived competency of an individual in conjunction with his or her business affairs. |
| **Reliability** | Cronbach's alpha's for the 75-item scale included:<br>*Sub-scales:* Innovation: .90; Achievement: .84; Self-esteem: .73; Personal control: .70.<br>*Components:* Affect: .84; Cognition: .84; Conation (behavior): .84 |
| **Validity** | Definition of entrepreneur: "an individual who has started more than one business, the last one being within five years, using some type of innovation. "IKnown entrepreneurs (n=54) and non-entrepreneurs (n=57) validated the EAO. There was relatively high correlations between factors. MANOVA found significant differences between non-entrepreneurs and entrepreneurs. Discriminant analysis revealed that 77% of cases (entrepreneur or non-entrepreneur) were correctly classified. |
| **Comments** | N/A |
| **Availability** | Robinson, P. B., Stimpson, D. V., Huefner, J. C., & Hunt, H. K. (1991). An attitude approach to the prediction of entrepreneurship. *Entrepreneurship theory and practice*, 15(4), 13-31. |
| **Reviewer** | Thema Monroe-White |

# 08 Entrepreneurial Behavior Inventory

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|---|---|
| **Instrument Title** | Entrepreneurial Behavior Inventory |
| **Suggested Use, if noted** | Identify EM (profit generation) among undergraduates |
| **Conceptual Framework, if any** | KEEN, and Rodriguez, Chen, Sheppard, Jin 2014 AERA |
| **Factors / constructs assessed** | Problem Solving, Logical Thinking, Engaging Stakeholders, Value Creation/ Risk Management, Gain Entrepreneurial Mindset, Analyze Market Conditions, Ability to Anticipate Technical Developments, Intrinsic Curiosity. |
| **Reliability** | Alpha for above factors ranges from 0.63-0.84; median=0.78. |
| **Validity** | Items were reviewed for relevance to entrepreneurial mindset by a panel of experts prior to survey deployment. |
| **Comments** | This is an instrument that is in-process. It's interesting because it began as a means of assessing the 3Cs. Most anticipated factors did not pan out, but new ones did. 2 of the 3 Cs (shown above) had decent reliability. |
| **Availability** | Li, C. Q., & Harichandran, R. S., & Carnasciali, M., & Erdil, N. O., & Nocito-Gobel, J. (2016, June), *Development of an Instrument to Measure the Entrepreneurial Mindset of Engineering Students* Paper presented at 2016 ASEE Annual Conference & Exposition, New Orleans, Louisiana. 10.18260/p.26819 |
| **Reviewer** | Gary Lichtenstein |

# 09 Innovator Mindset

<table>
<tr><td>Instrument Title</td><td>Innovator Mindset</td></tr>
<tr><td>Suggested Use, if noted</td><td>Means of assessing personal innovativeness using an Innovativeness Index.</td></tr>
<tr><td>Conceptual Framework, if any</td><td>Valuable Novelty Theory of Innovation; innovativeness is defined as “the capacity to produce valuable novelty.” Also uses Dweck’s definition of mindset.</td></tr>
<tr><td>Factors / constructs assessed</td><td>Twelve dimensions are the products of three “profiles” and four “phases” per value novelty theory.<br><br><table><tr><th rowspan="2">Profile</th><th colspan="4">Phase</th></tr><tr><th>Idea</th><th>Action</th><th>Reality</th><th>Feedback</th></tr><tr><td>Cognitive</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Values</td><td>-</td><td>-</td><td>-</td><td>-</td></tr><tr><td>Behavior</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table><br>Sample: managers and leaders from five organizations; 70% participation rate (n = 257); 45% female participation.</td></tr>
<tr><td>Reliability</td><td>Rasch analysis was used to conduct person reliability and item reliability. According to Stauffer, all reliabilities were sufficient to categorize people into two levels (more/less innovative or linear/iterative by phase) with the exception of Feedback Behavior dimension. Item level reliability scores across all 12 dimensions were at or above Cronbach alpha=0.95. Of the 159 individual items attempted, 77 were retained after reliability testing.</td></tr>
<tr><td>Validity</td><td>N/A</td></tr>
<tr><td>Comments</td><td>According to the author: “the goal here was to create a universal metric that could be replicated and used to compare degrees of innovativeness between individuals, groups, organizations and perhaps even cultures…an innovativeness thermometer.”</td></tr>
<tr><td>Availability</td><td>Theory: Stauffer, D. A. (2015). Valuable novelty: a proposed general theory of innovation and innovativeness. International Journal of Innovation Science, 7(3), 169-182.<br><br>Reliability: Stauffer, D. A. (2015). Evaluating mindset as a means of measuring personal innovativeness. International Journal of Innovation Science, 7(4), 233-248.<br><br>Validity: Stauffer, D. (2016). Personal innovativeness as a predictor of entrepreneurial value creation. International Journal of Innovation Science, 8(1), 4-26.</td></tr>
<tr><td>Reviewer</td><td>Thema Monroe-White</td></tr>
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# 10 ENTREMETRIC Quotient Assessment (EQA)

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|---|---|
| **Instrument Title** | EntreMetric Quotient Assessment (EQA) |
| **Suggested Use, if noted** | Self-assessment of entrepreneurial mindset strengths and weaknesses; assessment of team EM strengths and weaknesses. |
| **Conceptual Framework, if any** | Items were brainstormed initially by developers and entrepreneurs. Factors were derived empirically through exploratory factor analysis. |
| **Factors / constructs assessed** | 1. Perseverance, problem solving, ability to troubleshoot.<br>2. Focus, goal-setting, goal-directedness, leadership, decision-making.<br>3. Risk willingness/risk aversion.<br>4. Business acumen—basic business knowledge and terms.<br>5. A neurocognitive assessment of attitudes towards entrepreneurship. |
| **Reliability** | The company reports that each factor has high reliability. |
| **Validity** | High; items were derived based on feedback from 400 entrepreneurs. Individual scores are referenced against the means of entrepreneurs who have completed the instrument. |
| **Comments** | Instrument is proprietary. Developers are associated with the KEEN network at Bucknell. Individual results on each factor are compared to mean results of the entrepreneur reference group. This scoring technique is unique and increases the instrument's validity and credibility. |
| **Availability** | Authored by several on the Entremetric Team. Instrument is proprietary and can't be previewed. Info can be found at: www.entremetric.com. |
| **Reviewer** | Gary Lichtenstein |

# 11 Individual Entrepreneurial Orientation

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| **Instrument Title** | Individual Entrepreneurial Orientation |
| **Suggested Use, if noted** | Assessing higher education students "and other individuals" for entrepreneurial orientation. Instrument was adapted from a business firm-level measure. |
| **Conceptual Framework, if any** | Based on extensive review of the literature by Rauch, which showed 5 dimensions of entrepreneurial orientation at the organizational level (2009). |
| **Factors / constructs assessed** | Risk, Innovativeness, Pro-activeness |
| **Reliability** | Cronbach alpha for all 3 > 0.70 |
| **Validity** | Construct validity is based on correlations between the instrument and *entrepreneurial propensity* instrument. |
| **Comments** | Note, all 3 scales were significantly inter-correlated, suggesting that this is a unidimensional construct. Items were converted from a firm/organizational measurement to an individual one. |
| **Availability** | Bolton, D.L. & Lane, M.D. (2012). Individual entrepreneurial orientation: Development of a measurement instrument. Education & Training 54 (2/3), pp.219-233. |
| **Reviewer** | Gary Lichtenstein |

# 12 Growth vs Fixed Mindset Instrument for Assessing EM in Freshmen

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|---|---|
| **Instrument Title** | Growth vs Fixed Mindset Instrument for Assessing EM in Freshmen |
| **Author(s)** | Carol Dweck, cited in Reid & Ferguson |
| **Suggested Use, if noted** | Used by Reid and Ferguson to identify entrepreneurial growth among first year engineering students: "Entrepreneurial mindset in our study is operationally defined as a more growth-oriented mindset vs a more fixed-oriented mindset" p. FD-1 |
| **Conceptual Framework, if any** | Dweck, growth vs fixed mindset |
| **Factors/ constructs assessed** | Growth vs Fixed mindset |
| **Reliability** | Proven in prior studies |
| **Validity** | Not mentioned |
| **Availability** | Reid, K.J., & Ferguson, D.M. (2011). Enhancing the Entrepreneurial Mindset of Freshmen Engineers. Session F2D. 41 st IEEE conference, Rapid City IOWA. https://pdfs.semanticscholar.org/241b/775d5c2c73ce6416b7a6bb29022cfda4931e.pdf<br><br>Dweck, C. S., & Leggett, E. L., "A Social Cognitive Approach to Motivation and Personality, *Psychological Review*, 95(2), 1988, 256-273. |
| **Reviewer** | Gary Lichtenstein |

# 13 Entrepreneurial Mindset Profile (EMP)

<table>
<tr><td>Instrument Title</td><td>Entrepreneurial Mindset Profile (EMP)</td></tr>
<tr><td>Suggested Use, if noted</td><td>For would-be entrepreneurs to assess strengths and weaknesses. Also for organizations interested in assessing the entrepreneurial characteristics of employees. In academia, for student self-knowledge and pre/post program assessments.</td></tr>
<tr><td>Conceptual Framework, if any</td><td>Literature, Five Factor Model, loosely.</td></tr>
<tr><td>Factors / constructs assessed</td><td>
<table>
<tr><th>Traits (stable)</th><th>Skills (malleable)</th></tr>
<tr><td>Independence</td><td>Future Focus</td></tr>
<tr><td>Limited Structure</td><td>Idea Generation</td></tr>
<tr><td>Non-conformity</td><td>Execution</td></tr>
<tr><td>Risk acceptance</td><td>Self-Confidence</td></tr>
<tr><td>Action orientatioon</td><td>Optimism</td></tr>
<tr><td>Passion</td><td>Perseverance</td></tr>
<tr><td>Need to Achieve</td><td>Interpersonal Sensitivity</td></tr>
</table>
</td></tr>
<tr><td>Reliability</td><td>Factors ranged from alpha .67-.83; median TRAITS=0.71; median SKILLS=0.80</td></tr>
<tr><td>Validity</td><td>Based on literature and interviews w/entrepreneurs, asking them what characteristics distinguished them from non-entrepreneurs. Mostly minimal correlations between factors. Measure was referenced against the Five Factor Model (FFM), which has consistently identified entrepreneurs as high on Conscientiousness and Openness, and low on Neuroticism (Unstable emotions) and Agreeableness. The EMP had similar results.</td></tr>
<tr><td>Comments</td><td>Traits were a stronger predictor of entrepreneurs than skills among actual entrepreneurs, but not for students (who self-reported Entrepreneurs vs not-Entrepreneurs) for whom traits and skills contributed equally to the outcomes. Students who self-identified as Entrepreneurs evidenced significant differences on 13/14 scales compared to Non-Es. Article included a test of social desirability survey response and found no relationship among traits, but modest relationship with some skills.</td></tr>
<tr><td>Availability</td><td>Davis, MH., Hall, JA., Mayer, PS (2015) Developing a new measure of entrepreneurial mindset; reliability, validity, and implications for practitioners. Consulting Psychology Journal: Practice and Research, 68(1), 21-48</td></tr>
<tr><td>Reviewer</td><td>Gary Lichtenstein</td></tr>
</table>

# 14 Entrepreneurial Attitude Orientation (EAO) Scale

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|---|---|
| **Instrument Title** | Entrepreneurial Attitude Orientation (EAO) Scale |
| **Suggested Use, if noted** | Measurement of entrepreneurial traits among undergraduates.<br>Sample: 277 first-year or graduating students (72% were female; 76% first-year; 97% bachelor's students, 7% with previous entrepreneurial experience). |
| **Conceptual Framework, if any** | Adapts and builds on Covin and Slevin's (1989) EO measurement scale for applicability in the university context and for a student population. |
| **Factors / constructs assessed** | Six dimensions:<br>*1. Entrepreneurial desire*<br>*2. Innovativeness*<br>*3. Pro-activeness*<br>*4. Risk-taking*<br>*5. Networking*<br>*6. Confrontation tolerance* |
| **Reliability** | After PCA (Principal component analysis) Chronbach's alpha's ranged from .70 to .79. Dimensions: Entrepreneurial desire (n=2, .79); Innovativeness (n=5; .78); Risk-taking (n=6; .75); Pro-activeness (n=3; .69); Networking (n=2; .70) and confrontation tolerance (n=2; .70) |
| **Validity** | Independent samples t-test revealed that there were significant differences between student with and without entrepreneurial experience on five out of six variables (all but *confrontation tolerance*). |
| **Comments** | This instrument was originally created by Covin & Slevin (1989) to assess the entrepreneurial climate within an organization. It has been adapted by Taatila & Down. Two factors (Networking and Confrontation Tolerance were added by Taatila and Down, and Entrepreneurial Orientation in the original instrument was changed to Entrepreneurial Desire Moderate differences were found between 1) males and females on entrepreneurial desire, risk-taking and pro-activeness; and 2) students with and without work experience for the innovativeness and pro-activeness dimensions. |
| **Availability** | Taatila, V., & Down, S. (2012). Measuring entrepreneurial orientation of university students. *Education and Training*, 54(8/9), 744-760.<br>Covin, J. G., & Slevin, D. P. (1989). Strategic management of small firms in hostile and benign environments. *Strategic management journal*, 10(1), 75-87. |
| **Reviewer** | Thema Monroe-White |

# 15 Entrepreneurship Knowledge Inventory (EKI)

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|---|---|
| **Instrument Title** | Entrepreneurship Knowledge Inventory (EKI) |
| **Suggested Use, if noted** | Assess entrepreneurial knowledge of engineering undergrads (esp. 1 st year vs. seniors) |
| **Conceptual Framework, if any** | Based on NCIIA (VentureWell) Institutionalizing Entrepreneurship at Primarily Undergraduate Institutions (PUI E-ship Project, 2005) |
| **Factors / constructs assessed** | (Self-Assessed) Entrepreneurial Knowledge about:<br>1) Becoming & Being an Entrepreneur<br>2) Finance & Accounting,<br>3) People & Human Resources<br>4) Sales & Marketing,<br>5) Product Ideation and Development |
| **Reliability** | Cronbach alpha wasn't used because items were not dimensions of a construct, but topic areas, with items falling within each area. The purpose was to assess respondents' knowledge of items in each section. Unlike with constructs, consistent responses across items was not sought nor assumed. Reliability was ensured due to the specific, behaviorally-oriented response options (see *Comments*). |
| **Validity** | Seniors were identified as having high vs low Entrepreneurship experience. High E-ship students scored significantly higher than low E-ship students. |
| **Comments** | This is one of two tools developed by the authors to assess EM (also see #22). The study is unusual in that it compared results of students with E-ship experience to those without, providing criterion validity. Also, the response options are more specific than many self-report measures: Never heard of it (the term/concept); Heard of it but not sure what it means; Can explain it partially; Can explain in depth but not sure how to apply it; Can explain in depth and apply it. These response options improve reliability and validity. |
| **Availability** | Besterfield-Sacre, M., Ozaltin, N. O., Robinson, A., Shuman, L., Shartrand, A., & Weilerstein, P. (2013). Factors related to entrepreneurial knowledge in the engineering curriculum. *The Journal of Engineering Entrepreneurship*, 4(1), 31-38. |
| **Reviewer** | Gary Lichtenstein |

# 16 Gallup Entrepreneurial Profile (10)

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|---|---|
| **Instrument Title** | Gallup Entrepreneurial Profile (10) |
| **Suggested Use, if noted** | Entrepreneurial talent detector and development tool |
| **Conceptual Framework, if any** | Based on a prior measure, the Clifton StrengthsFinder, the EP10 is an online assessment that "helps people discover and develop their business-building talents." |
| **Factors / constructs assessed** | 1. **Confidence:** You accurately know yourself and understand others.<br>2. **Delegator:** You recognize that you cannot do everything and are willing to contemplate a shift in style and control.<br>3. **Determination:** You persevere through difficult, even seemingly insurmountable, obstacles.<br>4. **Disruptor:** You exhibit creativity in taking an existing idea or product and turning it into something better.<br>5. **Independent:** You are prepared to do whatever needs to be done to build a successful venture.<br>6. **Knowledge:** You constantly search for information that is relevant to growing your business.<br>7. **Profitability:** You make decisions based on observed or anticipated effect on profit.<br>8. **Relationship:** You have high social awareness and an ability to build relationships that are beneficial for the firm's survival and growth.<br>9. **Risk:** You instinctively know how to manage high-risk situations.<br>10. **Selling:** You are the best spokesperson for the business. |
| **Reliability** | Not reported, but may be available by inquiry. Items derived based on research and job analyses of entrepreneurs |
| **Validity** | Not reported, but may be available by inquiry. EP10 samples include entrepreneurs and non-entrepreneurs in US and internationally. |
| **Comments** | "While other assessments focus on testing knowledge or skills, the EP10 focuses on identifying talent—the most important factor in predicting success." Cost=$12 |
| **Availability** | Gallup: http://www.gallup.com/services/170867/entrepreneurship.aspx<br>also: https://www.gallupstrengthscenter.com/EP10/en-US/About |
| **Reviewer** | Gary Lichtenstein |

# 17 Entrepreneurial Behavior Inventory (EBI)

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|---|---|
| **Instrument Title** | Entrepreneurial Behavior Inventory (EBI) |
| **Suggested Use, if noted** | Assessing business owners and corporate entrepreneurs *(intrepreneurs)*, identifying types of entrepreneurs, and designing manager training |
| **Conceptual Framework, if any** | Derived empirically, based on 40 case studies of actual incidents faced by entrepreneurs, as well as attributes identified throughout the research literature. |
| **Factors / constructs assessed** | Innovativeness, risk-taking, change orientation, opportunism |
| **Reliability** | Final 4 factors and uni-dimensional (combined) factor Cronbach alphas were all above 0.80. |
| **Validity** | Content validity established through interviews with entrepreneur about (self-reported) attributes and comparing EBI pilot data to entrepreneur and executive MBA grad students' self-assessments. |
| **Comments** | The inventory is based on actual behaviors (vs. traits and literature-derived competencies) as discerned from 40 case studies based on actual experiences of business owners and corporate leaders. On the EBI assessment, respondents read 1-4 sentence scenarios and choose one of five action alternatives. |
| **Availability** | Theresa L.M. Lau, Shaffer, M. A., Chan, K. F., & Yan Man, T. W. (2012). The entrepreneurial behaviour inventory. *International Journal of Entrepreneurial Behaviour & Researc*h, 18(6), 673-696. doi: http://dx.doi.org.ezproxy1.lib.asu.edu/10.1108/13552551211268120 |
| **Reviewer** | Gary Lichtenstein |

# 18 Proactive Behavior Orientation (PBO)

| | |
|---|---|
| **Instrument Title** | Proactive Behavior Orientation (PBO) |
| **Author(s)** | Bateman & Crant |
| **Suggested Use, if noted** | Identify college students' and working professionals' proactive behavior orientation as a proxy for entrepreneurial inclination. |
| **Conceptual Framework, if any** | Locus of Control (Rotter, Bandura), Prospectors & Defenders (from organizational theory-- Miles & Snow) |
| **Factors/ constructs assessed** | Single factor: Proactive Behavior Orientation |
| **Reliability** | Cronbach Alpha = 0.83. |
| **Validity** | Criterion validity assessed by correlations of the PBO with extra-curricular activities, personal achievements, and analyses of respondents' choices of people they nominated who they believe have effected transformational leadership. |
| **Comments** | The instrument was crossed with the Big Five personality dimensions inventory (emotional instability, extraversion, openness/intelligence, agreeableness/friendliness, conscientiousness/will), Rotter's locus of control measure, and several author-created variables suggestive of inclination to change one's environment. The Proactive Behavior Orientation correlated significantly with *conscientiousness, extraversion, need for achievement and need for dominance*. |
| **Availability** | Bateman, T.S., & Crant, M.J., (1993). The Proactive Component of Organizational Behavior: A measure and correlates. *Journal of Organizational Behavior* 14(2), pp.103-118. |
| **Reviewer** | Gary Lichtenstein |

# 19 Entrepreneurial Competence Behavioral Assessment

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|---|---|
| **Instrument Title** | Entrepreneurial Competence Behavioral Assessment |
| **Suggested Use, if noted** | Provide juniors and senior high school students (in Flanders, Belgium) concrete feedback about their "generic entrepreneurial competence." |
| **Conceptual Framework, if any** | Man, 2012: Context of (experiential) learning |
| **Factors / constructs assessed** | *Performance Orientation, Creativity, Taking Initiative, Taking Calculated Risks, Perseverance, Communication, Planning & Organizing, Decisiveness, Collaboration, Reflection* |
| **Reliability** | Ranges from alpha = 0.31-0.65 |
| **Validity** | Initially, items were determined based on frequency of mention in an extensive literature review (See Tables 2 & 3). Factor list was reduced based upon respondents' ability to measure the construct and teachers' ability to score it (final factors are shown above). |
| **Comments** | Instrument was created for and validated by a sample of 16-18 yr old secondary students (high school) who participated in an entrepreneurial simulation. Note p.33 & 34: List of broad and specific E-"sub- competencies" throughout research literature. This assessment is intended to be an observational measure, based upon observable behaviors, completed by teachers. |
| **Availability** | Shelfhout, W., Bruggemann, K., Maeyer, S.D. (2016). Evaluation of entrepreneurial competence through scaled behavioural indicators: Validation of an instrument. *Studies in Educational Evaluation*, 51 (2016) 29-41. |
| **Reviewer** | Gary Lichtenstein |

# 20 Assessment of Engineering Entrepreneurship Education

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|---|---|
| **Instrument Title** | Assessment of Engineering Entrepreneurship Education |
| **Suggested Use, if noted** | GET and GSE were used to identify entrepreneurs/innovators. LABS was used initially to gauge one's orientation towards leadership, then used later by Wise & Rzasa as one of 3 measures of entrepreneurial disposition. These were measures used to evaluate the success of a grant-funded E-ship program at Penn State. |
| **Conceptual Framework, if any** | All were derived based on prior literature. |
| **Factors / constructs assessed** | See table below |

| GET | LABS | GSE |
|---|---|---|
| Need for Achievement | Beliefs About Authority/Control | GSE: 8 items, single factor + Regretful Thinking<br><br>1 item |
| Autonomy | Beliefs re: Ethics should play a role in leadership | |
| Drive/Determination | Inclination towards lifelong learning | |
| Risk Taking | Importance of cooperation in org. context | |
| Creativity | Should leadership be open to change and risk-taking | |
| TOTAL | Extent to which someone believes that systemic process in organizations influences leadership | |
| | Extent to which one believes that orgs should be organized with top-down leadership | |
| | Extent to which one believes that responsibility for taking risk lies with org leaders only. | |
| | Cooperative/open leadership processes. | |

| | | | |
|---|---|---|---|
| **Reliability** | GET: Scales had low alphas, summed total had alpha=0.70 | LABS: All scales alpha over 0.80 | GSE & Regretful Thinking: Cronbach alpha for GSE measure=0.89 Regretful thinking alpha=NA, b/c only 1 item |
| **Validity** | GET: Items piloted w/a sample of new business owners | LABS: Used in prior research. Instrument validity not reported | GSE: Piloted using a random sample of patent inventors |
| **Comments** | Note that one-year progress was updated in a 2005 JEE paper (Bilen, S.G., Kisen-weather, E.C., Rzasa, S.E.--2005). In 2005, the GET instrument is no longer referenced. | | |
| **Availability** | Wise, J.C., Rzasa, S.E., (2004). Institutionalizing the Assessment of Engineering Entrepreneurship. Paper presented at the 34th Annual Conference of IEEE Frontiers in Education Conference. Session T2E. This paper cites:<br>**LABS:** Weilkiewicz, R.M. (2000). The Leadership Attitudes & Beliefs Scale: An instrument for evaluating college students' Thinking About Leadership and Organizations. *Journal of College Student Development*, v31, n3, pp.335-346. www.psycholosphere.com/The%20Leadership%20Attitudes%20and%20Beliefs%20Scale%20by%20Wielkiewicz.pdf<br>**GET:** Stormer, F., Kline, T., Goldenberg, S. (1999). Measuring entrepreneurship with the General Enterprising Tendency Test: Criterion-related validity and reliability. *Human Systems Management*, v18, pp.47-52. http://dev.pue.itesm.mx/DoctoradoNebrija/MaterialGral/Measuring%20entrepreneurship%20with%20the%20general%20enterprising%20tendency%20GET.pdf<br>**General Self-Efficacy (GSE):** Chen C.C, Greene, P.G., Crick, A. (1998). Does entrepreneurial self-efficacy distinguish entrepreneurs from managers? *Journal of Business Venturing*, v13, pp.295-316. www.sciencedirect.com.ezproxy1.lib.asu.edu/science/article/pii/S0883902697000293 | | |
| **Reviewer** | Gary Lichtenstein | | |

# 21 Entrepreneurial Self-Efficacy

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|---|---|
| **Instrument Title** | Entrepreneurial Self-Efficacy |
| **Suggested Use, if noted** | Identifying entrepreneurial self-efficacy (ESE) among college-aged students. |
| **Conceptual Framework, if any** | Lit review. Authors modified the framework of Mueller & Goic (2003) and Stevenson et al, 1985. Items were derived based on prior literature and input from a panel of entrepreneurs. |
| **Factors / constructs assessed** | Assesses Entrepreneurial S-E along 6 dimensions: *Searching* for viable idea/ recognizing an opportunity; *Planning*—creating a business model; Marshaling resources; *Implementing* (human dimension), *Implementing* (financial dimension). Plus, *Attitude towards venturing.* Instrument works better for assessing dimensions separately, rather than as a single score. |
| **Reliability** | Reliability for each of 6 scales is alpha>0.83 |
| **Validity** | Instrument items were developed using a panel entrepreneurs. Scales were validated by the same panel. |
| **Comments** | Instrument was created using a sample of nascent entrepreneurs, with items and scales co-developed with a panel of experienced entrepreneurs. |
| **Availability** | McGee, J., Peterson, M., Mueller, S., Sequeria, J. (2009 ). Entrepreneurial Self-Efficacy: Refining the measure. *Entrepreneurship Theory & Practice*, July, pp.965-988. http://cmapspublic3.ihmc.us/rid%3D1253386188218_95923794_9629/ Entrepreneurial%20self%20efficacy-refining%20the%20measure- jeffery%20 mcgee.pdf |
| **Reviewer** | Gary Lichtenstein |

# 22 Entrepreneurial Mindset Rubric

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|---|---|
| **Instrument Title** | Entrepreneurial Mindset Rubric |
| **Suggested Use, if noted** | Assesses entrepreneurial mindset of upper level (predominantly) engineering undergrads taking entrepreneurial technology courses. |
| **Conceptual Framework, if any** | Adapted from the "Entrepreneurial Orientation Scale" (Coven & Sleven, 1989). |
| **Factors / constructs assessed** | (Self-Assessed) Entrepreneurial Knowledge about: *Product-Market Innovation* (emphasizes R&D vs improvement of existing products), *Pro-Activeness of Decision-Making* (initiate actions, then respond vs. extreme caution before acting), *Risk-Taking* (inclination towards higher vs. lower risk projects). |
| **Reliability** | Students were presented scenarios, to which they were asked to respond. Responses were scored by two raters (background and experience of raters is not reported), with 0.83 inter-rater reliability. |
| **Validity** | Not discussed. |
| **Comments** | This is one of two tools developed by the authors to assess EM (also see #15). The in-process measure describes a pre/post measure, with results not presented. The article is interesting in terms of the elements of the rubric and the pre/post scenario approach. |
| **Availability** | Shartrand, A., Weilerstein, P., Besterfield-Sacre, M., Olds, B.M.(2008). Assessing Student Learning in Technology Entrepreneurship. Paper presented at the 38th annual Frontiers in Education conference, session F4H-12 |
| **Reviewer** | Gary Lichtenstein |