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## **THE SOURCES OF INNOVATION AND CREATIVITY IN THE SYSTEM OF HIGHER EDUCATION**

**Summary:** The following pages represent a comprehensive summary of current research and theory on the sources of innovation and creativity in individuals. Based on the recurring concepts in the existing literature, the paper concludes with some recommendations for how education systems can best foster these attributes in students. Both research and recommendations have been conducted with a view to informing world workforce development efforts within the context of the new global economy. The following key questions are discussed:

- What do we know about the sources of creativity and innovation in individuals?
- What contributes to the development of successful entrepreneurs?
- What actions should the education system take to promote innovation and creativity among students?

**Keywords:** creativity, innovation, knowledge, entrepreneurship, leadership, social behavior.

### **What Are the Sources of Creativity and Innovation in Individuals?**

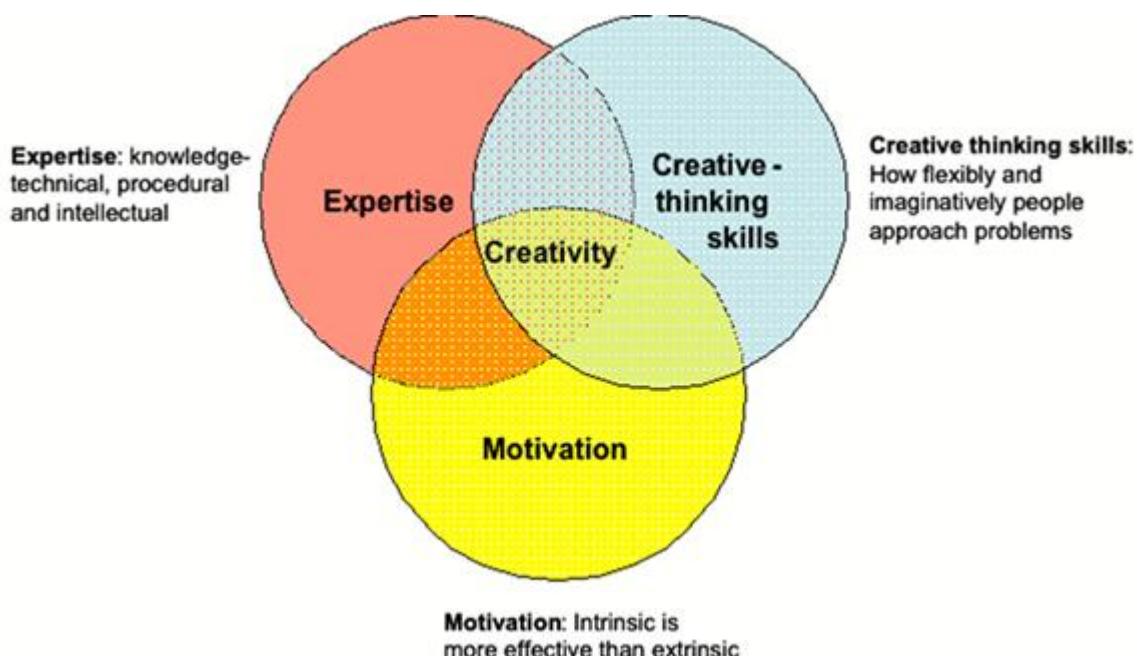
A variety of theorists, using case studies, experiments and a variety of research methods, have attempted to better understand the sources of creativity and innovation in individuals. While these efforts have contributed significantly to broadening our

comprehension of the subject, there is nonetheless disagreement between theorists and many hypotheses that remain to be fully substantiated. The challenge lies partially in the nature and definition of creativity itself. Broad, complex and multi-faceted, creativity can take many forms and can be found within a variety of contexts. It is embodied by individuals with a broad range of personal characteristics and backgrounds. It appears that the only rule is that there are no hard and fast rules concerning the sources of creativity. As such, the following paragraphs synthesize the current viewpoints, with the caveat that our understanding of the topic is still a work in progress.

Teresa Amabile, PhD in Psychology and Head of the Entrepreneurial Management Unit at the Harvard Business School, has provided the field with one of the most simple and yet comprehensive frameworks for the topic. As depicted in the diagram below, creativity arises through the confluence of the following three components:

- Knowledge: All the relevant understanding an individual brings to bear on a creative effort.
- Creative Thinking: Relates to how people approach problems and depends on personality and thinking/working style.
- Motivation: Motivation is generally accepted as key to creative production, and the most important motivators are intrinsic passion and interest in the work itself.

### Three Components of Creativity



Multiple experts provide frameworks and hypotheses on the sources of creativity yet, it appears that the vast majority of their important contributions to the theory can be categorized as falling within Amabile's three intersecting circles above. Thus, this section of the paper will make use of Amabile's framework as the organizing principle, within which other theorists' viewpoints are categorized.

### **Knowledge**

Amabile describes knowledge as all the relevant information that an individual brings to bear on a problem. Howard Gardner goes deeper into the topic and explains that there are two types of knowledge that may be required for creativity. On one hand, in-depth experience and long-term focus in one specific area allows people to build the technical expertise that can serve as a foundation, or playground for creativity within a domain. At the same time, creativity rests on the ability to combine previously disparate elements in new ways, which implies a need for a broader focus and varied interests. Thus, perhaps the best profile for creativity is the T-shaped mind, with a breadth of understanding across multiple disciplines and one or two areas of in-depth expertise. Indeed, this is what Frans Johansson recommends in his book, *The Medici Effect*. He explains that “we must strike a balance between depth and breadth of knowledge in order to maximize our creative potential,” (Johansson, p. 104). He suggests that one way to improve breadth is to team up with people with different knowledge bases. The educational implications of this recommendation are perhaps in the realm of greater focus on interdisciplinary study and having students collaborate on group projects with team members of varied interests.

Dean Keith Simonton, professor of Psychology at UC Davis, has conducted historiometric studies of great creators. Using a large sample size of successfully creative individuals, historiometric studies quantify the otherwise qualitative characteristics of test cases (their developmental, differential and social backgrounds, for example) and through analysis of the data, attempt to derive some general laws or theories regarding the sources of creativity. Simonton's research supports the idea that individuals must develop in-depth domain expertise to be creative. He explains that we can conclude with great confidence that creative output is linked to the amount of time a person is actively engaged in a creative domain. The relationship tends to be a curvilinear, inverted backwards J function of career age. In other words, creativity production increases with years in the field until reaching a maximum at which point it begins to taper off. Howard Gardner's research into the sources of creativity supports this idea and further extends it to a “ten-year rule”: ten years is the

approximate time required to build the domain knowledge and expertise needed to spur creative successes. Many creative individuals seem to have breakthroughs in ten year intervals.

## Creative Thinking

While both Amabile and Gardner assert that thinking is a key aspect of the creative process, they address this topic at a high level. Amabile suggests that key aspects of creative thinking are:

- Comfort in disagreeing with others and trying solutions that depart from the status quo.
- Combining knowledge from previously disparate fields.
- Ability to persevere through difficult problems and dry spells.
- Ability to step away from an effort and return later with a fresh perspective (“incubation”).

Other theorists have addressed the topic of cognitive function from multiple angles. Sternberg's article, “Creativity and Intelligence” in the Handbook of Creativity, provides an overview of the multitude of theories that have been proposed concerning the relationship between creativity and intelligence. While there is no consensus on the subject, multiple theories provide insight.

Ultimately, Sternberg promotes a “triarchic theory”, asserting that there are three main aspects of intelligence that are key for creativity – synthetic, analytical and practical:

1. **Synthetic (creative):** the ability to generate ideas that are novel, high quality and task appropriate. One aspect of this is the ability to redefine problems effectively and to think insightfully. Sternberg also notes that the basis for insightful thinking involves knowledge acquisition in three forms:

- selective encoding: distinguishing relevant from irrelevant information.
- selective combination: combining bits of relevant information in novel ways.
- selective comparison: relating new information to old information in novel ways.

2. **Analytical:** Critical/analytical thinking is involved in creativity as the ability to judge the value of one's own ideas, to evaluate their strengths and weaknesses and suggest ways to improve them.

3. **Practical:** Ability to apply intellectual skills in everyday contexts and to “sell” creative ideas.

In sum, within the three main components of the sources of creativity in individuals it appears that the following are key to individual creativity:

- Knowledge: the balance between breadth and depth of knowledge.
- Thinking: a strong ability to generate novel ideas by combining previously disparate elements. This “synergistic” thinking must be combined with analytical and practical thinking.
- Personal motivation: the appropriate levels of intrinsic motivation and passion for one’s work combined with appropriate synergistic motivators and self-confidence.
- Environment: a non-threatening, non-controlling climate conducive to idea combination and recombination, such as the “intersection”.
- An explicit decision to be creative along with a meta-cognitive awareness of the creative process can go a long way in enhancing long-term creative results.

### **What Contributes to the Development of Successful Entrepreneurs?**

Not surprisingly, many of the characteristics of successful entrepreneurs echo those of the successfully creative individual. Since the 1950s, many studies have attempted to analyze these characteristics. Contrary to the popular myth of the entrepreneur as a superstar, Hatch and Zweig explain that many tend to embody the concepts of ‘average’ and ‘unexceptional’. Of the entrepreneurs they studied, few were academic standouts or excelled in sports or some other activity. Most came from middle or upper class backgrounds. “The evidence showed that the founders of rapidly growing firms were actually average and sometimes mediocre performers in other aspects of their lives,” (Hatch & Zweig, p. 68-9). Moreover, their paths toward entrepreneurship differed: some did and some didn’t have post-secondary degrees. Some began engaging in entrepreneurial activity very young, and some later in life. Thus, defining just what sets the successful entrepreneur apart from the rest of the population cannot be attributed to their experience. While entrepreneurs’ backgrounds are unexceptional and their paths diverse, what unites them is the entrepreneurial spirit. Timmons analyzed more than 50 studies of the characteristics of entrepreneurs and found a consensus around the following general characteristics of that embody this spirit: 1) commitment and determination, 2) leadership, 3) opportunity obsession, 4) tolerance of risk, ambiguity and uncertainty, 5) creativity, self-reliance and ability to adapt, and 6) motivation to excel, (Byers, et al, p. 2). In addition, data indicates that entrepreneurs show a high tolerance for

risk, a desire for control and autonomy (exemplified in wanting to work for themselves), as well as strong personal ambition, perseverance and decisiveness. In the decisiveness dimension, entrepreneurs differ from others in that “many of their decisions are made alone or with modest amounts of advice, must be made quickly, and can have a significant impact on the company. These entrepreneurs must also be able to make mid-course corrections. The alacrity and flexibility displayed in making these decisions – in changing them if necessary— are what distinguishes the entrepreneur. Contrast this with the typical process in a large corporation, where time consuming, extensive analysis precedes each decision, and feedback is slow in coming,” (Hatch & Zweig, p. 71).

Closely related to decisiveness, entrepreneurs also demonstrate a readiness to act. They turn decisions into actions. They demonstrate a preference for learning through trial and experimentation rather than reflection and theory, which has clear implications for project-based learning and any other such action oriented programs.

In addition to the entrepreneurial spirit, the generation of the business ideas is important. Idea generation involves insight – the ability to perceive an opportunity where others may not. This is potentially a skill developed by creative-problem solving “problem finding” techniques, as well as consideration of Kim and Mauborgne’s value innovation questions and Drucker’s seven sources of innovation, as described in the previous sections. Facilitating idea generation, low levels of associative barriers may also enhance entrepreneurial abilities. Thorough exposure to two or more cultures helps people break down barriers. Such persons “seem to have an advantage in the range of hypotheses they are apt to consider, and through this means, in the frequency of creative innovation”. These individuals are not wedded to one point of view and are generally aware that there are multiple ways of looking at something. Thus, they can approach a situation from a variety of perspectives.

Paul Maeder, founder of Highland Capital, a venture capital company, works with numerous entrepreneurs and sees the traditional education system as potentially limiting the creativity involved in entrepreneurship by fostering false associative barriers and entrenching people in singular perspectives. Maeder has noted that many innovators seem to be self-taught, and sites examples of innovators who were not formally trained. Thomas Edison, Charles Darwin and Steve Jobs all had little higher education but were avid readers and self-educators.

“Through school, mentors and organizational cultures, education tends to focus on what a particular field has seen as valid. If, for instance, you wish to be a great medical doctor, there are rules that must be mastered. A good education will teach you these rules.

You learn what past experts and thinkers concluded and use their experiences to build your own expertise....The price for such an approach, however, is that one more easily becomes wedded to a particular way of doing things. As a result, associative barriers are erected, making intersectional ideas less likely....Instead, we must employ tactics that allow us to learn as many things as possible without getting stuck in a particular way of thinking about those things.” (Johansson p. 50).

By learning fields on our own, we have a greater chance of approaching them differently. The correlation between formal education and one’s success as a creator looks like an inverted U. “That is, formal education first increases the probability of attaining creative success, but after an optimum point it actually lowers the odds. This point occurs a bit earlier for artistic careers and a bit later for scientific paths...All of this suggests that it makes sense to spend significant amounts of time reading and drawing, learning and experimenting, without guidance from instructors, peers, and experts,” (Johansson, p. 52-53). Thus, there is a complex relationship between expertise in a domain and an entrepreneur’s capacity to think beyond that domain’s traditional paradigm.

What about education in entrepreneurship itself? When it comes to developing entrepreneurial capability, much of the literature agrees that the topic is not easily taught in a classroom setting. Entrepreneurship is best carried out by individuals for whom the set of personal characteristics mentioned above comes naturally. Thus, not everyone is well suited for the job and so entrepreneurship education and training should tread carefully. “It would be wrong to delude kids into believing that the calling was easy or for everyone,” (Southon and West, p. 1).

Nonetheless, there is still a place for entrepreneurship courses. Teaching entrepreneurship can build awareness and help potential entrepreneurs discover their calling and hone their abilities. And, for those not interested in entrepreneurship, discovering it’s not for them is also useful. Additionally, regardless of their entrepreneurial proclivity, all students could benefit from complimentary skills training such as basic financial accounting, selling, and history of the rise and fall of businesses and of the life experiences, both of highly successful entrepreneurs and more moderately successful ones.

Although it is frequently argued that the most essential entrepreneurial capabilities are personality traits that cannot easily be taught in a classroom, entrepreneurship training courses have nonetheless flourished in recent decades, perhaps for the reasons above. Courses

are being offered both in business schools and in other disciplines, such as engineering and the arts, both at the graduate and undergraduate level.

In their study "Impact of Entrepreneurship Education," Alberta Charney and Gary Libecap concluded that entrepreneurship education helps produce self-sufficient enterprising individuals, successful business leaders and champions of innovation. Their findings were based on a comparison of University of Arizona Berger Entrepreneurship Program graduates to other University of Arizona Business School Graduates (Kauffman Center, p.2). Additionally, there is indication of a link between these entrepreneurship programs and an increased number of start-ups launched by students either during or closely following school (Kauffman Center, p. 7-8). While the causal link is not clear, the Kauffman center explains,

"Research indicates entrepreneurship program graduates are three times more likely to be involved in the creation of a new business venture than their nonentrepreneurship business counterparts. Further, Alberta Chaney and Gary D. Libecap found that graduates of the University of Arizona's Berger Entrepreneurship Program were 11 percent more likely than were non-entrepreneurship students to own their own businesses after graduation," (Kauffman Center, p. 8).

In terms of teaching and curriculum design, many entrepreneurial programs employ innovative methods. Experiential learning is central to most entrepreneurship training courses at the university level. Real world projects, internships, case studies and business plan competitions are key elements. At Babson college, for example, the Freshman Management Experience allows students to plan, launch, manage and liquidate a for-profit venture. The University of Maryland houses undergraduate business students in an eDorm, an incubator like facility from which they can start and run their businesses, (Kauffman Center, p. 9).

Beyond pedagogy, mentoring and networking have also been identified as extremely important for aspiring entrepreneurs (De Faoite, et al, p. 433). The involvement of entrepreneurs either in the classroom or as mentors and judges of business plan competitions is a key element of many entrepreneurship programs. As such, many programs are run or assisted by former or current entrepreneurs who play a role as adjunct or non-tenured faculty. While such individuals are crucial to maintaining a practical, hands-on perspective in the classroom, the Kauffman Center suggests that their roles need to be complemented by increased opportunities for tenured entrepreneurship faculty who will focus on research to advance the intellectual underpinnings of the field, which are currently still in infancy. These faculty "must be supported, mentored and encouraged." (Kauffman Center, p. 19).

While many business schools teach entrepreneurship, there is a view that the methods need an overhaul. David Birch, an entrepreneurial expert believes that entrepreneurship would be best taught not through the classroom, but through apprenticeship. Intuitively, an experiential approach seems most appropriate for entrepreneurship training. One study of traditional lecture- tutorial entrepreneurship training in Singapore argues for this point exactly, sighting evidence of success through a problem-based curriculum. See Lynda Wee's article, "A Problem-Based

Learning Approach in Entrepreneurship Education: Promoting Authentic Entrepreneurial Learning". David Birch also explains that if courses are to be taught in entrepreneurship, they need traditional courses in sales and product development but also need to understand how to work with people and influence them which is perhaps a less well-recognized need. Birch explains,

"For entrepreneurs to succeed they have to create a needed product or service, sell it, and work with people. So, a change in curriculum is needed. The first course is sales—how do you make sales? The second course is on how to lead people and to get people to go with you to do something. The third should be how to create a product or service that people or companies need. If any curriculum is going to be relevant for entrepreneurs-to- be, it has to have these courses," (Aronsson, p. 2).

Byers expands on Aronsson's concept, stressing the importance of the social aspects of entrepreneurship: While much of the discussion of entrepreneurs and entrepreneurship focuses on the individual, Byers asserts that this emphasis a "fundamental attribution error". Observers place too much credit with personality and individual characteristics and can't see factors outside the person that "drove him or her to action". Instead, they suggest that entrepreneurship should be more accurately viewed as a social activity. They explain:

"Building a company entails hiring, organizing, and inspiring a collection of people who typically need to get start-up funds from others, to buy things from other people, and, ultimately, flourish or fail together as a result of the ability to sell things to yet another group of people. The emphasis on rugged individualism is so prevalent in western culture that many of the lists of "characteristics of successful entrepreneurs" barely reflect that launching a start-up entails constant interaction with others," (Byers, et al, p. 4).

As such, they explain that entrepreneurship is embedded in a social context and is facilitated by a person's social network. They conclude that the study and teaching of entrepreneurship should include a greater focus on social behavior – on how to identify and

maintain relationships that will be crucial to success and to build the skills related to interpersonal influence, persuasion and negotiation (Byers, et al, p. 5-7).

Despite an increased proliferation of entrepreneurship programs, research and multiple viewpoints on the topic, there is still no set curriculum prescribed for the subject and there appears to be little in the way of evaluation of current effectiveness of these programs in terms of their contribution to the emergence of successful entrepreneurs. Such evaluation would need to be undertaken before more specific recommendations regarding just what contributes to entrepreneurial development.

A starting point for further research could be with the Consortium for Entrepreneurship Education (<http://www.entre-ed.org>). This Consortium serves as a clearinghouse and information center for the topic of entrepreneurship education. Their website includes access to information resources, teaching materials, networks and membership details. Their resources focus on life long learning with content aimed at elementary through university-level and professional training. In addition, the Consortium provides a “Toolkit for National Content Standards for Entrepreneurship Education”. This model aims to serve as a framework for developing entrepreneurship curricula at all levels. They offer fifteen major standards, divided into the following three categories:

- Entrepreneurial Skills: the unique traits, behaviors and processes that differentiate an entrepreneur from an employee or manager.
- Ready Skills: the business, or entrepreneurial, knowledge and skills that are prerequisites or co-requisites for the study of entrepreneurship.
- Business Functions: the business activities performed in starting and running a business.

A deeper review of the pedagogy and educational standards that this Consortium promotes may provide insight into the most popular and/or effective methods and techniques of teaching and learning entrepreneurship.

## **Recommendations for Education**

1. **Design educational curricula that promote all three components of “successful intelligence”:** As Sternberg explains, today’s educational model generally supports the development of one kind of analytical thinking. This needs to be balanced with a focus on the synthetic, analytical and practical aspects of successful intelligence, especially as the combination of the three results in creativity. The use of divergent thinking exercises, open-ended challenges such

as those posed by PBL programs and the thinking tools proposed by organizations such as the Center for Creative Learning can all play a role in the development of the creative aspects of successful intelligence.

2. **Promote the Decision to Be Creative and a Meta-Cognition of the Creative Process:** Following Sternberg's suggestion that the one consistent attribute among successfully creative people is there explicit decision to pursue a creative path, educational programs should not only aim to enhance student creativity, but should also directly teach students about the field of creativity itself so that they gain an explicit awareness of their own creative potential, as well as and understanding of methods of enhancement. With this knowledge, they can both make an informed decision to pursue creative activities and at the same time, better control and direct the development of their abilities. This meta-cognition of the creative process should also involve explicit awareness of the practical skills involved in creativity such as the processes of managing one's emotions, one's ability to persevere in the face of challenge, the marshaling of cognitive resources, learning one's strengths and weaknesses and managing time allocating to creative pursuits. These are skills that can and should be explicitly discussed in the classroom.
3. **Foster classroom environments and pedagogical approaches conducive to intrinsic motivation:** Help students find their passion and shield them from the potentially damaging impacts of rewards, extrinsic motivators and experiences of failure. The effort to help students develop passion should also involve the promotion of confidence, persistence and risk taking. Where appropriate, allow students to define their own problems and conduct a self-assessment of their efforts and outcomes, rather than always having work both defined and evaluated by teachers. It is too often that students curiosity, motivation and creativity are stifled by the educational environment. A deeper understanding of how and why this happens and how to correct for it are needed. Recommendations from the Educational Programs section of this paper should be considered, such as making grades informational rather than controlling, allowing students room to choose their own projects.
4. **Increase the usage of problem and project based learning in the classroom:** Executed correctly, PBL programs have shown significant promise to increase a broad range of thinking abilities, including creative thinking and help link

education to relevant, ill-defined, real-life experience. This connection is crucial for engaging students and increasing motivation, as well as helping develop the thinking skills crucial to “successful intelligence” as defined by Sternberg. A deeper review of some of the more well-regarded PBL programs as well as the principles of effective PBL and their impacts on creativity will be key to understanding how to best implement this recommendation. The more closely linked these projects are to students real lives and environments the more meaningful they become.

5. **Re-align the high-stakes testing system to reflect the need for focus on creativity:** Strike the right balance between ensuring that classrooms focus on basic skills, but that teachers still have time and autonomy for a broad range of activities so that the testing of these skills does not crowd out creative pursuits. At the same time, if what gets tested is what gets taught, ensure that schools are as accountable for creativity as they are for performance in basic skills. While a wide range of tests for creative thinking exist, the most appropriate method of assessing creativity is to review creative outputs themselves. Portfolios, demonstrations and exhibitions of student work are suitable methods of ensuring that creative projects are incorporated into teaching and learning.
6. **Further integrate games and play into education:** As discussed by Daniel Pink, play has a central role in the creative process. In addition, the enjoyment factor involved in games has potential to greatly enhance motivation and interest among students, thereby opening doors for flow and creativity.
7. **Increase the use of interdisciplinary learning:** Lessons that span multiple subject areas will familiarize students with the concepts of linking otherwise separate concepts or disciplines to discover new ideas at the intersection of fields. Especially in the upper grades, having students work in teams where diverse talents, interests and thinking styles are represented will offer practice in the group dynamics that lead to organizational innovation.
8. **Improve career counseling and opportunities for career exploration:** The greatest potential for creative success will lie among students who find their passion and dive into it early in life. Potential implications of this viewpoint are that the educational system should provide greater focus on helping students identify areas of interest – areas where they can achieve the a state of flow which leads to growth of skill and confidence, the states under which creativity

blossoms. As a corollary, the educational system should help students strike the right balance of depth and breadth of knowledge (the T-shaped mind). There is a concern that many liberal arts students are graduating from universities as generalists and have missed early opportunities to discover an area of passion or interest in which to build deeper knowledge.

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