IDENTIFYING INTUITIVE LEARNERS' CHARACTERISTICS IN INVENTION PROCESS; THE CASE OF IRANIAN EXCERPT INVENTORS

GhanbarMohammadiElyasi*

Omid Mirzaei**

Abstract

Learning methods are of the most researched areas due to their important implementation in educational developments. These methods have been categorized by several indicators. As a case in point we can see formal/informal learning or implicit/explicit learning methods. There is one more categorization includes intuitive/analytical learning methods. Since there is intuitive learning method, there are intuitive learners who have specific characteristics. These characteristics have been identified rarely in previous researches. In fact, previous researches mainly discuss about these characteristics in educational situations. The present paper represents intuitive learners' characteristics in invention processes. Interviews have been done with 11 excerpt inventors who have unique inventions. The results have demonstrated common points with previous researches and also have illustrated extra attributes.

Keywords: Intuition - Intuitive learning - Invention - Intuitive learners' characteristics - Learning from intuition - Entrepreneurship

* Associate Professor, Faculty of Entrepreneurship, University of Tehran, Iran

** M.Sc Student, Faculty of Entrepreneurship, University of Tehran, Iran

Introduction

Olson was one of the first scholars whose research concentration's was on intuition in entrepreneurship domain. He mentioned that entrepreneurial intuition helps individuals to discover clues and unfamiliar information and then to interpret them holistically and eventually to recognize opportunities in order to exploit them (Olson, 1985).Schumpeter considered innovation as central element in economic growth understanding (Maclaurin, 1953). There is a transformation between invention and innovation when an invention is introduced for commercialization in form of a new or improved product or process (Maclaurin, 1953).

Inventors can help to entrepreneurial science-based firms' establishment. In fact, they carry out aforementioned contributions in two distinctive levels including: human capital and social capital (Murray, 2004).Intuition is a crucial element in inventors' decision making processes. Some of inventors consider that as guidance in their mental evaluations. Intuition makes a correlation relationship between individual's characteristics and his/her inventions (Henderson, 2004).

Scholars have conceptualized intuition in several ways (Behling and Eckel, 1991). As a case in point, Bruner asserts that intuition is the ability to reach to the solution of a problem or issue without awareness to the process which leads to this solution. He indicates that intuitive individuals often do not have specific trends to disclose how they reach to solution. In addition, they may also do not have consciousness about aspects of the problem which they have focused on (Bruner, 1960).Generally we can conceptualize intuition in four ways including: intuition as a characteristic, intuition as a set of activities, intuition as experience, intuition as an unconscious process. If we consider intuition as a characteristic, we have contemplated it as a constant and inherent attribute which cannot be improved and learned. However the constant and inherent attribute's role on intuition is still misty. On the other hand, if we consider it in three remaining ways, intuition will be improvable, and therefore learning from intuition could define through them (Behling and Eckel, 1991).

Jean Piaget has explained the process of thought improvement in children in a four stage process. These four stages includes: Sensorimotor stage, Preoperational stage, Concrete operational stage, Formal operational stage. He considers intuitive thought formation stage as a sublevel of the second stage (Preoperational stage) which occurs between four to seven years old that exactly is the time in which the child begins to ask and seeks argumentations. He believes this is intuition

because the child knows there is a great amount of knowledge inside himself/herself but he/she does not know how he/she gained that (Piaget, 1996).

Learning is the process in which knowledge creation occurs through experiences' transformations (Kolb, 1984). Organizational learning is the process in which organizational knowledge creation occurs (Farr, 2000). In general, there is a relationship between direct and indirect organizational learning with entrepreneurship (Easterby, 2003). Individuals are considered practical in entrepreneurial learning. In fact, they learn from their experiences continuously (Holmqvist, 2000).

Intuitive learning is a deep and independent thought which leads to understanding of abstract concepts (Schroeder, 1993). Intuitive learners enjoy dealing with abstract concepts (Felder, 2002). In general there are two thought systems including: explicit thought system and implicit thought system. In the implicit system, thought occurs automatically without any effort. It is quick and usually creates self-confidence. This thinking method accompanies with unconsciousness. On the contrary, in the explicit system, there is a need to effort, and it is controllable and accompanies with consciousness. Briefly, the implicit thought system is "Intuition" and the explicit thought system is "Analysis" (Hogarth, 2001). These two systems are complementary to each other (Semetsky, 2004).

Last but not the least, there are several researches on intuitive learners' attributes. However, almost all of them have been conducted in educational domains like universities. Since intuitive learning occurs in empirical situations during a task, it shouldbefall on a basic path. Moreover, one of the most intuitive processes is invention process. Since there is no scientific work on combination between invention process and intuitive learning, we have researched on intuitive inventors who have learned from their invention process. In other words, our goal was to identify intuitive learners' characteristics who have been involved in a unique invention process.

Literature Review

Intuition

If we look at deferent definitions of intuition which has been presented by scholars, we will find that there are several perspectives on this concept. We have categorized these definitions in two distinctivecategories. The first category is inferential intuition. Inferential intuition sometimes is considered as "Analysis frozen into habit". In fact, this processing method is based on automatic

reactions which esteems from quick pattern recognition and experiences (Simon, 1987). The second category is holistic intuition. From this point of view, it is a nascent information restructuring in mind domain (Mintzberg, 1998). In other words, we have two types of intuition including inferential and classic. Classic intuition is general intuition. In fact, it is a general and non-analytical judgement which is based on complex information integration. In contrast, inferential intuition is an analytical judgement which has been automatic by experience (Hill, 1987).

Due to previous researches on concept of intuition, we have considered the following definition as basic definition of intuition in our research.

Intuition is an unconscious ability (Dane, 2007) in order to reach to creative and unique solutions which have not came from linear reasoning process (Rew, 1986), but it is the result of the individual's general expertise experience (Novicevic, 2002) and high concentration on the problem and also it has a moral-emotional dimension (Bradley, 2007).

In addition we have extract intuition definition's dimensions as follows:

- Intuition is a methodology to give solutions.
- Intuition is a creative element, because it is not based on previous analysis and reasoning.
- Experience and expertise have crucial roles in intuition.
- Intuition is accompanied by high concentration on the problem.
- Intuition has a moral-emotional dimension, because high concentration usually occurs based on the enthusiasm and passion.

Learning from intuition

Learning from intuition includes indirect understanding, imagination and a feeling about an event in future and it is run through unconsciousness (Felder, 1988).Learning from intuition is attending to the patterns and finding them (Cook et al, 2009). There are generally two types of learners in universities including sensing learners and intuitive learners. 60 percent of entering students are sensing learners and the rest are intuitive ones. Intuitive learners like concepts, ideas and abstractions. They often progress from theory to practice and prefer open-ended instructions. They usually demonstrate a high degree of autonomy in their learning. In contrast to the sensing learners, intuitive learners prefer diversity in ideas and learning options. On the other hand, sensing learners like highly structured instructions, linear and sequential learning. They prefer

concrete issues and dislike abstract ideas. In addition, they have lack of confidence in the learning process (Schroeder, 1993).

In addition to the concept of learning from intuition itself, it has several common dimensions with other learning styles. Informal learning's characteristics are implicit, unintended, opportunistic and unstructured (Eraut, 2004). Therefore intuitive learning is analogous to the concepts like informal learning, implicit learning and tacit knowledge.

Intuition in inventors

Invention is a creative thought which represents in a physical formation (Plaisted, 1932).Based on the USA's law, an inventor is who perceives an idea in order to make an invention. Note that it is not necessary that inventor must have done all the invention process alone, but he/she only should has a claim about a crucial part of the invention (Kennedy et al, 2012).

Based on the results of the related researches, all inventors claimed about existence of intuition in their daily solving problems (Henderson, 2004). Tacit knowledge has an effective role in innovation process, specially in its initial steps like invention and new product development (Koskinen and Vanharanta, 2002).

Research Methodology

Statistical Population

The present paper is empirical due to the purpose and employs narrative approach method for collecting qualitative data. We have considered the excerpt inventors as our research sample. Excerpt inventors are individuals who have real and Non-imitative inventions. In other words, their invention is unique and the result of their mind creativity. The other reason for choosing these inventors is the high probability of occurring intuition in their invention process. We have set two indicators for determining whether an inventor is an excerpt one or not including: Searching authentic global databases like US-Patent, Euro-Patent and J-Patent and the amount of market share which the product will dedicate to itself in the commercialization phase.

Sample Size Determination

We have determined the proper number of sample by theoretical saturation law. Due to this law, interviews should continue to the interviewee whose words will not add any extra information to the previous ones. In this paper, the theoretical saturation has occurred on 7th interview.

However, we have continued our interviews till 11th in order to be certain that no data has been missed.

Sampling Methodology

Our sampling methodology was targeted sampling. Targeted sampling methodology means targeted selecting of the research units in order to obtain knowledge or information. In this method, we should select sample individuals by the way in which we can reach to our research's goal. Therefore, we have selected individuals who have unique invention and learned from that.

Data Gathering Methodology

Our data gathering methodology have been narrative approach. Furthermore, our technique was semi-structured interviews with excerpt inventors. The structure of interviews has been setby combining three categories including: 5W1H framework, STAR framework and the invention process.

5W1H Framework

Target is to answer the following questions in 5W1H perspective (Ikeda et al, 1998):

What: What is specific event? What are its dimensions?

Where: Where has event occurred?

When: When has event occurred?

Who: Who has been involved in event creation?

Why: Why has event occurred?

How: How has event occurred?

STAR Framework

STAR perspective accentuates following aspects as essential pillars of an event's occurrence (Kessler, 2006):

Situation: Specific situations which have been existed in the time of the act's occurrence.

Task: Job situation and role of effective individuals in act creation.

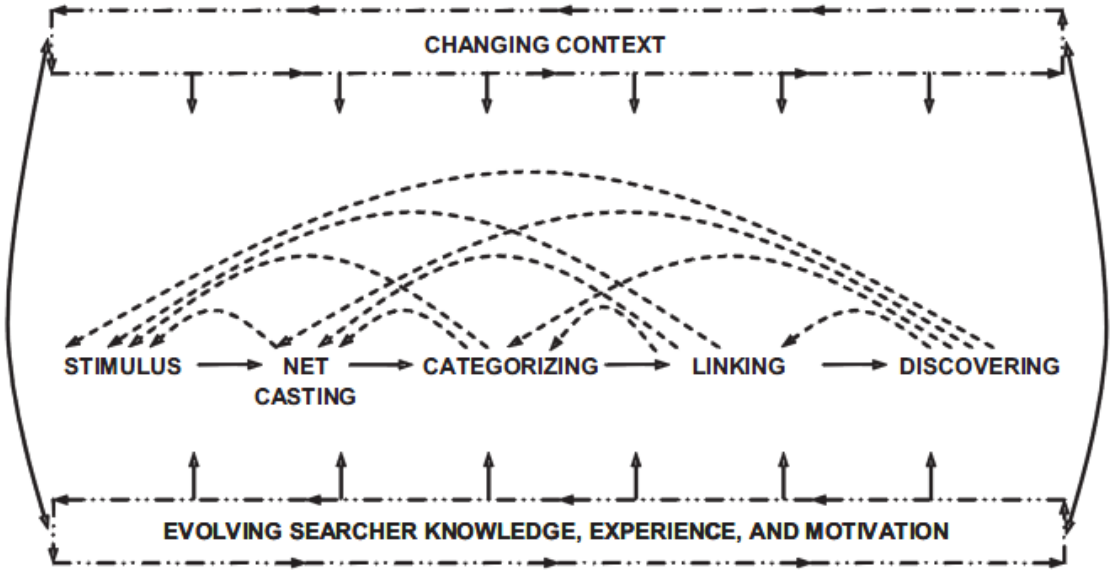
Action: Specific individuals' actions

Result: Results of the specific act.

Invention Process

Maggitti et al (2013) has suggested the following model for invention process.

Dynamic Emergent Model of the Search and Discovery Process of Invention



The model depicts that invention process begins with at least one stimulus. Note that the stimuli can be an extremely simple issue. Then the inventor starts to gather data and information. Individuals exploit different methods and tools to achieve essential information. This is the stage in which inventors use "Zooming" technique. In fact, they zoom into the concepts and relationships in order to understand details. Then they zoom out from them to see whole issue. The "Zooming" technique provides a holistic and careful understanding about the issue. The third stage is categorizing in which inventors merge information which have been gathered through previous stage in order to make related categories. This stage could be directed by inventors' cognitive process. After categorizing new and previous information, inventors link between unrelated issues and make unique ideas. The outcome of this stage will be an insight which can represent in the form of a hypothesis and go to the evaluation stage (fifth stage). The final stage is invention (discovery) stage. Inventors test their ideas which came from the previous stage.

Reliability

To ensure about the interviews' reliability, we have implement both internal and external checks. For internal test, we asked interviewees to comment on the extracted verbal evidences from interviews. For external test, we have consulted with three experts in the specific fields.

Validity

The following issues have been considered to ensure about the interviews' validity.

1- We have used STAR and 5W1H patterns which are authentic and related to the target of our research.

2- We have used invention process model (Maggitti et al, 2013) which covers all dimensions of invention process. In addition, there is no vague point in the process by this model.

3- We have had an interview with an inventor who has a nominal invention before interviewing with main samples. Therefore, we could check our interview's structure and improve that.

4- We have consulted with some experts in order to design best interview's structure due to our research goal.

Findings

Based on the results of our interviews, there are several characteristics associated with intuitive learners. We have asserts these characteristics in the following Table.

Our Research Results	Intuitive Learners' Characteristics	Literature Review	
Expertise		Seeing big pictures of the problem	Schroeder (1993)
Autonomy		Concentration on imaginative possibilities	
Persistence		Love world of concepts, ideas and abstractions	
Self Confidence		High degree of autonomy	
Experience		Prefer diversity in ideas and learning options	
Active Personality		Comfortable with ambiguity	
Inter-disciplinary Perspective		Prefer theories and concepts	Felder (2002)
Pry		Love innovation and hate redundancies	
Self-Inquiry		Hate details and like complexities	
		Quick but careless	

Expertise

Almost all of our interviewees were expert in their field which was related to the invention domain. Expertise is a combination between educational careers and work endeavors. This combination will occur through the time. Therefore it is time-consuming. In addition, expertise characteristic has an effective role on problem solving ability and reducing the amount of the possible alternatives.

Autonomy

Autonomy and self-dependence are of the basic characteristics of intuitive learners. Autonomy means independency in tasks. It does not mean that intuitive learners do not take contributions from other individuals along invention process. In fact, it means that they basically are independent people in their entire life and they use other individuals' work just for ease of the process's progress. Note that this characteristic may exhibit itself in the formation of interest to their country's autonomy and sufficiency. Sentences like "You should only count on yourself" prove this ability in these persons.

Persistence

Persistence means insistence and effort in order to reach to the desired goal. Our results indicate that persistence is the most important characteristic of intuitive learners. Because it dedicates the greatest number of verbal evidences itself. Hence, based on the interviews, persistence is the most important characteristic of these individuals. One of the interviewees points out to this characteristic as the following.

"You cannot see any success which has not had failures inside itself. You must try so hard."

Self Confidence

Self Confidence means individual's perception of his/her ability in completing tasks well. Based on the results of our interviews, these individuals believe in their enough ability in tasks and they also bear process's possible problems very well. As a case in point one of the interviewees states this characteristic like this.

"I have started with debt, but I believed myself from the beginning."

Experience

When we talk about experience, we mainly mean work experience. However, related educational experiences have effective role in invention process. In fact, individual's work experience which

is often associated to invention domain has positive effective role in his/her ability to problem identification and reaching to solutions.

Active Personality

Based on the results of our interviews in this research, intuitive learners have active characters. In fact, they hate to be reactive. The active personality allows them to be positivist and helps them to be responsible about the results of the tests and experiments. In other words, this characteristic helps them to have internal control center.

Inter-disciplinary Perspective

We have found that all of the inventions of our samples are in inter-disciplinary fields including Physics, Chemistry, Computational Programming, Nano-Technology and etc. Furthermore, based on our interviews, intuitive learners reach to a mature level of inter-disciplinary perspective during intuitive learning process.

Pry

Our interviews indicate that some of the inventors pry. They want to know more about their interests. Moreover, pry could be a stimulus for these people to start the process and bear its difficulties. Note that this pry should arise from the childhood period.

Self-Inquiry

Inventors usually have self-inquiry characteristic. They ask questions about everything by this ability. Furthermore, this attribute will be a tool for them to learn tacitly. Tacit learning which comes from occupational situations begins by this ability and continues along invention process.

Discussion and Conclusion

Based on the literature, Intuitive learning is extremely analogous to informal learning. Since informal learning occurs through a complementary process like working, we have selected invention process as the basic path. The reason is based on two distinctive issues. Firstly, the invention process is fulfilled by intuition and intuitive perceptions. Therefore, intuitive learning is more probable to occur during the aforementioned process. Secondly, even though there are some researches which have worked on intuitive learners' characteristics, they all have made researches on intuitive learners in educational situations like universities. We have considered invention process as a basic path in order to identify intuitive learners' characteristics on an

extremely empirical path like invention. Even though some of the identified characteristics have been noticed in the previous researches, new ones have been recognized through this research.

We found that learning from intuition occurs along the process of invention. By that, we assert that we should use the term "Learning in Intuition" instead of "Learning from Intuition". The reason is that learning occurs in the middle of the process. This point of view considers intuition not only as a tool of learning, but also it indicates that intuition is simultaneously a manner of learning and a tool.

References

1- Behling, O., Eckel, N. L. (1991). Making Sense out of Intuition. *The Executive*, Vol. 5, No.1. pp. 46-54.

2- Bradley, R. T. (2007). The Psychophysiology of Intuition: A Quantum-Holographic Theory of Nonlocal Communication. *The Journal of Global Education*, 63:2. 61-97.

3- Cook, D. A., Thompson, W. G., Thomas, K. G., Thomas, M. R. (2009). Lack of interaction between sensing–intuitive learning styles and problem-first versus information-first instruction: a randomized crossover trial. *Adv in Health SciEduc*, 14:79–90.

4- Dane, E., Pratt, M. G. (2007). Exploring Intuition and Its Role in Managerial Decision Making. *Academy of Management Review*, Vol. 32, No. 1, 33–54.

5- Easterby, M., Lyles, M. (2003). *The blackwel handbook of organaizational learning and knowledge management*, Oxford: Blackwell.

6- Eraut, M. (2004). Informal learning in the workplace, *Studies in Continuing Education*, 26:2, 247-273.

7- Farr, K. (2000). Organizational learning and knowledge managers. *Work Study*, Vol. 49 No. 1, pp. 14-17.

8- Felder, R. M, Silverman, L. K. (1988). Learning and Teaching Stylesin Engineering Education. *Engr.Education*, 78 (7). 674-681.

9- Henderson, S. J. (2004). Product Inventors and Creativity: The Finer Dimensions of Enjoyment. *Creativity Research Journal*, 16:2-3, 293-312.

10- Hill, O. W. (1988). Intuition: Inferential heuristic or epistemic mode? *Imagination, Cognition, and Personality*, 7: 137–154.

11- Hogarth, R. M. (2001). *Educating Intuition*. The University Of Chicago Press.

12- Holmqvist, M. (2000). The dynamics of experiential learning: balancing exploitation and exploration within and between organizations. Doctoral dissertation, Stockholm: School of Business.

13- Ikeda, T., Okumura, A., Muraki, K. (1998). Information classification and navigation based on 5W1H of the target information. *COLING '98 Proceedings of the 17th international conference on Computational linguistics*, Volume 1 571-577.

14- Kennedy, J. P., Watkins, W. H., Ball, E. N. (2012). *How to Invent and Protect Your Invention: A Guide to Patents for Scientists and Engineers.* John Wiley and sons Publication.

15- Kessler, R. (2006). *Competency-based interviews*. Career Press.

16- Koskinen, K. U., Vanharanta, H. (2002). The role of tacit knowledge in innovation processes of small technology companies. *Int. J. Production Economics*, 80: 57–64.

17- Maclaurin, W. R. (1953). The sequence from invention to innovation and its relation to economic growth. *The Quarterly Journal of Economics.*

18- Maggitti, P. G., Smith, K. G., Katila, R. (2013). The Complete Search Process of Innovation. *Research Policy*, 42: 90-100.

19- Mintzberg, H., Ahlstrand, B., &Lampel, J. 1998. Strategy safari: A guided tour through thewilds of strategic management. New York: Free Press.

20- Murray, F. (2004). The role of academic inventors in entrepreneurial firms: sharing the laboratory life. *Research Policy*, Vol. 33: 643-659.

21- Novicevic, M. M., Hench, T. J., Wren, D. A. (2002). Playing by ear . . . in an incessant din of reasons: Chester Barnard and the history of intuition in management thought. *Management Decision*, Vol. 40 Iss: 10 pp. 992 -1002.

22- Olson, P. D. (1985). Entrepreneurship: Process and abilities. *American Journal of Small Business*, 10(1): 25–31.

23- Piaget's theory of cognitive and affective development: *Foundations of constructivism (5th ed.)*. Wadsworth, Barry J. White Plains, NY, England: Longman Publishing. (1996). xi 195 pp.

24- Plaisted, H. M. (1932). What is Invention? *Journal of the patent office Societ, 14: 328.*

25- Rew. L. (1986). Intuition: Concept analysis of a group phenomenon. *Advances in nursing science*, 8:2.

26- Schroeder, C. C. (1993). New Students: New Learning Styles. *Change*, Vol. 25, No. 5 (Sep. - Oct., 1993), pp. 21-26.

27- Semetsky, I. (2004). The Role of Intuition in Thinking and Learning: Deleuze and the pragmatic legacy. *Educational Philosophy and Theory*, Vol. 36, No. 4.

28- Simon, H. A. (1987). Making management decisions: The role of intuition and emotion. *Academy of Management Executive*, February: 57–64.