Chapter 5

Discussion

The hallmark of human cognition is its flexibility and its processes. We are able to pursue multiple goals or tasks simultaneously, but can also prioritize. There is accord with both our internal states and the continually changing nature of the external environment. Moreover, we are able to create some creative solution for any problem by using tools. If the task is ill-defined or open ended, a person may solve it with the help of past experience or insight. Even though, we are able to create something new and make unusual use of tool to solve problem which can have dramatic effect our interaction with the environment. This ability suggests that information related to tool-use task must be actively represented in a way that can help action and solution to a problem.

In our today's fast paced and competitive life, we have to face various types of problems. In ill defined and open ended problems, our cognition system plays a very important role. In fact, it is the cognitive system which enables an individual to make accurate and independent decisions for creative use of tools with the help of planning, abstract thinking, dialectical reasoning, initiating appropriate actions and perceived perception. Creative tool use is one such cognitive operation that requires individual thinking and reasoning process backed by perception.

The present study was designed to investigate the phenomenon of 'tool use' (mainly in creative problem solving) by engaging individuals varying in creativity, affordance and dialectical reasoning. The first objective, “to tap the process of tool use in varied task situation, and "To develop insights into novel (unique) and varied uses of variable tools". " was achieved by administrating tasks involving five tools in fixed solution, easy, open solution and unusual/difficult solutions. It was further investigated, "To identify the circumstances under which differential process, viz; affordance, dialectical reasoning and creativity are used by the tool user" for achieving our purpose Non-verbal test of creative thinking and Attributional dialectical reasoning scale was administered to a large sample (N=152). Present research findings are as follows:
In the current study, creativity was found to be a significant source of variance for time taken to solve the problem. It means that those persons who were high on creative ability, they took less time in comparison to those who were low in creative ability to complete open solution subjective-judgmental task. However in case of fixed solution, creativity interacted with task difficulty. Low creativity subjects took more time to solve difficult problems than high creative's, but they were at par with high creative's in solving easy problems. Our findings are in line with Mednick, et.al., (1964) study, which reported that highly creative subjects performed significantly better than low creative subjects and the effect of specific time priming was significantly greater than no priming. Our findings are in contrast with the outcomes of Amabile, et al., (2002) study, which reported that creativity related cognitive processes can be constrained directly by time pressure. All the subjects, whether high or low in creativity, did solve the problem in the fix time of 5 minutes in each problem. The subjects in the study were free to attempt again when moves did not go in right direction. Michael et. al., (2008) found that sufficient time instructions led people to solve problem better. Whereas Ernestina et.al., (2011) found an interaction between time pressure and task completion.

In another study, Michael, & Heath (2008), found that the participants who were advised that the amount of time was sufficient to complete the task performed significantly better in comparison to those participants who were advised that the amount of time was not sufficient to complete the task. But Ernestina, & Tina (2011) suggested that there was no effect of time priming and task completion. In the present study, all the tasks were solvable and they time was sufficient even for low creative and low dialectical subjects that too for relatively difficult problems.

Another finding of the present study for number of moves and number of attempts was unique in its mode of administration as no such study has been reported to our knowledge that has followed this feature and procedure. It was also found that creativity was also a significant source of variance for number of moves in open solution subjective-judgmental problem. Persons who were high on creative ability, took less number of moves in comparison to those who were low on creative ability. But in case of fixed solution, instead of dialectical reasoning and creativity could not interacted with task difficulty. Thus, Participants solved the tool-use task problem on the basis of creative ability in open solution subjective-judgmental task/problem.
Results revealed the role of creativity and interaction between creativity and dialectical reasoning in number of attempts to solve problem. A person who is high on creativity as well as dialectical reasoning took less number of attempts to solve open solution subjective-judgmental task. Thus persons who were high on creativity and dialectical reasoning found the creative solution on the basis of past experience and insight. However in case of fixed solution, it was not true, on the other hand creativity interacted with task difficulty. Low creativity subjects took many attempts to solve difficult problems but they were at par with high creatives in easy problems. Our findings are in accordance with Wu, & Chiou (2008), Hui-Liu, & Yang (2015) and Paletz, & Peng (2009) study. Wu, & Chiou (2008) found that relativistic thinking and dialectical were positively correlated with creative performance. Another study by Paletz, & Peng (2009) also suggested that creativity was positively associated with dialectical thinking. But our findings are in contrast with the outcomes of Hui- Liu, & Yang (2015) study, which revealed negative relationship between creative personality and dialectical thinking.

The findings of the current study for number of perceived affordances reported that dialectical reasoning was found to be a significant source of variance. It means that those person who were high on dialectical reasoning ability, they perceived more affordances in comparison to those low on dialectical reasoning to solve tool-use task/problem in open solution subjective-judgmental task/problem. This shows that solving tool use task problem in dialectical way, features of tool play an important role. When there is a supported interaction of past experience, tool's prominent features and its compatibility with environment, then a person solves the problem on the basis of dialectical reasoning. However in case of fixed solution, dialectical reasoning interacted with task difficulty. Low dialectical reasoning subjects they perceived more affordances to solve difficult problems but they were at par with high dialectical reasoning in easy problems. Our findings are in line with the outcome of Osiurak, & Gall (2010) theory, which reported that humans forced to use body action-and to perceive affordances-to operate the product of the reasoning (pushing buttons with the fingers). This principle is known as dialectic.

There is a lack of studies to our knowledge that have recognized similar or diverse outcomes, so more research in this area in needed for insight. when the feedback taken from the participants, they said that, “when they were solving the tool use task problem they found that the tool they were using was seen and used by them before also but not as wanted now. They
solved the problem on the basis of their past experience and features of the tool.” Overall it can be said that there is an important role of past experiences of a person in different and dialectical uses of a tool in creative problem solving. Use of naive subjects may answer.

It is not clear in what way the properties of the tools (affordances) trigger the dialectical reasoning ability of the perceiver to develop strategy of using the tool to solve the given problem. Could it be vice versa that dialectical reasoning ability trigger the perceptual process to perceive the affordances in the given tool.

**Conclusions:**

- 'Creativity' was found to be a significant source of variance for time taken and number of moves in problem solving using tools. Speed and efficiency of tool use problem solving is determined by one's creativity. Creative's were efficient.
- Creativity and dialectical reasoning, both were found to be significant source of variance for number of attempts. People high in creativity as well as high in dialectical reasoning plan well and easy before going to use tools to solve problem in one go and proper direction.
- A notable omission was the interaction between creativity and dialectical reasoning, that could suggest some convergence of the two human abilities from cognitive domain. The exception was for number of attempts taken to solve the problem.
- However, for number of perceived affordances, dialectical reasoning was found to be a significant source of variance. It means that dialectical reasoning was playing a significant role in problem solving by use of tool. High dialectical reasoning Ss perceived more affordances and properties of tools used to solve problem. For easy problems, more affordances were perceived than difficult ones. In a way experimenter's criterion of difficulty seems to be validated by the subjects. High dialectical reasoning subjects perceived more affordances in tools of difficult task. Low dialectical reasoning subjects perceived more affordances for easy task.
- Task difficulty, as expected was also found to be a significant source of variance in problem solving by using tool. As the problems require some unusual or novel use of the common tool other than its usual use, the element of challenged and difficulty was there.
Results did not support the overwhelming role of dialectical reasoning (i.e., an ability to conjoin the past experiences and presently perceived affordances in tool/situation) in tool use behavior. In a way it is not supporting the theory of Gibson (1977), Chemero (2003), Chi-Tai (2012), Cardellicchio, et.al.,(2013) and other champions of affordances from ecology.

The findings go with creativity as an ability almost independently, neither going with dialectical reasoning ability additively or any other form of interaction. It did not go with Yang, et.al., (2010) perspective.

**Limitations:**

In spite of the positive outcomes of the study, current findings do not claim that these abilities (creativity and dialectical reasoning) are the only ones playing significantly role in the execution of novel tool use task, nor would these findings propose that they are the basic components of problem solving because past experiences and insight may have equal role in tool use problem solving task.

In the current study, only non-verbal test of creativity was used as was considered relevant to problem solving by using tool and not the entire test of creativity, while dialectical reasoning and other five tool use task problems were not standardized like test of creativity. Though in pilot work both, the test and the tasks were standardized on limited subjects.

The correspondence among five tasks may reveal some carryover effect due to repeated measure design. Examination of transfer of performance may also lead to fruitful outcomes as every subject performed all the tasks.

**Implication and application:**

Cognitive control should be useful e.g., for calculating probabilities before making the decision, several decisions have to be made for developing a strategy and control behaviour accordingly when making the choices for any type of problem solving uncontrolled and non-calculating moves would lead to failure.

Considering the importance of cognitive abilities in cognitive process for varied life outcomes, the identification and development of successful cognitive skill may not only
promote deficits in clinical sample but may also promote cognitive performance and
development in healthy adolescents as well adults.

- Every individual has his/her own styles to solve problems which depends on cognitive
  ability and temperamental traits. Different type of cognitive ability and temperament has
  its own style to achieve success. Experience and exposure to varied uses of different tools
  can help in personal selection (placement and recruitment of right person in a specific
  profession).

- Findings may be useful in the industries where multitasking is very important and with
  less number of tools more diverse functions are possible, like mobile phone.

- There may also be long term educational implications to enhance feeling of self-efficacy
  by creative uses of available tools.

- Findings may also be helpful in the understanding of various cognitive processes better
  to formulate significant training for those who face difficulties to deal effectively
  according to the changing technological demands or as per requirements of the new
  environment.

**Future directions:**

There are some suggestions and future directions coming up from the study for the
methodological refinements and guidelines to be considered in the future research:

- It would be worthwhile if in some other project different demographical variables (e.g.
  age, educational qualification) could be taken and some kind of categorization could be
  done to ascertain as to whether cognitive abilities/process are same or different in using
  tool and also to see developmental pattern.

- Studies may be undertaken to evaluate the effect of training and development skill
  programs on problem solving by using tool, especially in deficit sample, and study its
  effect on different component of tool use and cognitive process. Apart from day to day
  setting, current study also can be extended to educational and clinical contexts. The few
  existing studies have provided mixed but encouraging findings, indicating that cognitive
  skill development training has the potential to improve academic abilities, particularly in
  the field of creative problem solving in using tool. The beneficiaries from these studies
  will not only be normal persons, but also those having some deficit in cognition. Further
empirical work is needed to test these predictions and develop stronger theoretical model which accurately represent this complex area of study. So, clearly, more research is required to have a better understanding of the process mediating the transfer of cognitive skill development to academic abilities. This type of studies will be most important for developing skill development programs to the person with special needs.

- It was derived among the studies in review that there was a lack of merging of instrumental tool use approach and mental/cognitive problem solving approach. For this gap the present study was planned. The experiments conducted also revealed the interest and motivation with which subjects performed to an upper level. Both approaches also steered by different group of professionals, the mental problem solving is dominated by psychologists whereas the instrumental problem solving involves variety of professionals ranging from anthropologists to information technology tool designers.

- The findings imply educational and vocational translational scope, particularly, task and game designing for inculcating innovative interest early and to enhance during the job.