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Investigation the Relationship between Intrinsic Motivation and Creative Production on Solving Real Problems

ABSTRACT

This study was designed to investigate whether Intrinsic Motivation (IM) related to the creative production on solving real problems that measured based on two criteria: novelty and appropriateness. 10th-grade students in Oman represented by 367 students (male and female) from eight schools (rural and urban) were the sample of the study. Work Preference Inventory from T.M. Amabile, B. Hennessy and E. Tighe (1994) was manipulated to assess intrinsic motivation. Problem-Solving Test (PST) developed by researchers was used to measure creative production on solving real problems through content contexts of subjects such as Arabic Language, Social Studies, and Science. Findings showed that IM correlated positively with novelty and appropriateness. MANOVA test showed that main effect of school type was significant for novelty and appropriateness, but gender was not. Analysis of simultaneous regression indicated that intrinsic motivation and gender predicted the total score of problem solving test, but school type was not. The implications of the study enhance our understanding of the intrinsic motivation as a personality trait on developing creativity among school students.

Key words: Intrinsic motivation, creative production, solving real problems, novelty and appropriateness, and students in Oman.

INTRODUCTION

Intrinsic motivation is a salient characteristic of the creative person. Accordingly, P. Haensly and E. Torrance (1990) stated that the most important trait of the creative person is being in love with what one is doing. Creative performance has its origin in the motivation of the individual, not in cognitive abilities (Hayes, 1989). According to T.M. Amabile (1990), talent, personality, and cognitive abilities seem to be insufficient for creative achievement, instead, the most important characteristics are personality motives and love.

Meanwhile, E. Deci and R. Ryan defined the IM (Intrinsic Motivation) as "*Human motives stimulated by the inherent nature of the activity, their pleasure in mastering something new, or its natural consequences*" (Deci & Ryan, 1985:35). IM

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is an essential condition of creative acts, as articulated by authors such as M. Csikszentmihalyi (1990), T.M. Amabile (1990), H. Gardner (1993), R. Sternberg and T. Lubart (1995), and E. Deci and R. Ryan (2008). Intrinsic motivation is conducive to creative thinking because it is related to task satisfaction and enjoyment. Regardless of control conditions, this virtue relies on an individual's perseverance and pursuit of the task engaged. It flourishes in supportive conditions of autonomy, and when a person feels independent. Accordingly, T.M. Amabile (1982 and 1990) had provided principle that intrinsic motivation conducive to creativity, but extrinsic motivation not. Self determination theory of E. Deci and R. Ryan (1985) emphasized on the interesting and enjoyable tasks that conduct to generate creative ideas

Many studies such as by T.M. Amabile (1990); E. Deci and R. Ryan (1992); B. Patrick, E. Skinner and J. Connel (1993); and Z. Xiaomeng (2007) investigated the positive relationship between intrinsic motivation and creativity. In contrast, some studies such as H. Katz (2001) revealed that intrinsic motivation is not related with creativity. Further, B. Cooper and B. Jayatilaka (2006) revealed also that intrinsic motivation did not surpass extrinsic motivation in enhancing creativity. Moreover, most of previous studies that tested the relationship between psychological traits and creativity shed light on the experts or scientist, but little is known about this relationship among adolescents-non experts' learners (Jravis, 2009).

PROBLEM STATEMENT AND HYPOTHESES

Empirically, current endeavours of the Ministry of Education in Oman are limited on developing teachers' instructional skills and providing the curricula with creative activities. The instruction-cognitive styles are inadequate to help students to improve their creative behaviour and productivity (Torrance & Kathy, 1990). Exploring students' psychological traits such as intrinsic motivation facilitates selection of the proper instructional strategies and curricula activities because these traits affect students' cognitive process and immunize the students against external constraints. Creative acts is not an easy work, instead it requires perseverance, persistence, and challenge that provided when the student involve the tasks and enjoy them. Whether creativity improves among them or not is due to the fact that creativity vastly differs between students (Ruscio & Amabile, 1999).

On the other hand, previously no study has been conducted to relate creative thinking with psychological traits in Oman. Few studies were conducted to reveal the impact of some instructional strategies on creativity such as *brainstorming* by Mohammed T. Alkiyumi (2002); the *structural learning* by A. Alghafri (2004); and *CORT program* by W. Almahri (2005). The findings showed that the strategies enhanced creative potential, but we don't know to which extent that the students' traits influenced the findings. Furthermore, despite of the importance of the psychological traits in learning process, particularly

in creativity, unfortunately there are no programs for cultivating them among students. Instead, extrinsic motivations used widely to stimulate the students (e.g. rewards, grades, and praise). Curiosity of students is stifle in primary stages because of using traditional instructional strategies and focusing on the memorized-information as desirable outcomes (Rassekh, 2004).

Although the Ministry of Education has begun since 1998 using instructional strategies and providing creative activities in the curricula for developing creative thinking among students, but creative production is still unsatisfied. This fact investigated in studies by W. Albahrani (2002), Mohammed T. Alkiyumi (2002), A. Alghafri (2004), and W. Almahri (2005). In addition, the final report of evaluation the first cycle of education in Oman pointed out that the students' attainment in innovative thinking and problem-solving was under expectations (MoE, 2006). Current study's findings determine whether the students' psychological traits related to the creative potential within its limitations.

The hypotheses of this study are as follows:

H_{01} : There is no significant association between intrinsic motivation and problem-solving abilities.

H_2 : There are no significant differences in the main effects of the linear combination of novelty and appropriateness with respect to gender, school type, and the interaction between gender and school type.

H_3 : Combination of the five predictors: (1) intrinsic motivation, (2) curiosity, (3) self image, (4) gender, and (5) school type, is not predict significantly the total score of PST.

METHODOLOGY

About the Sample. The participants were 367 of 10th-grade students from eight schools of two regions in Oman. Four schools were selected in each region (i.e. urban-male school, urban-female school, rural-male school, and rural-female school). Sixteen clusters (classes) were randomly selected, two classes in each school. The students' ages were between 15 and 17.

About the Instrumentation. To measure intrinsic motivation among students, the Work Preference Inventory (WPI) developed by T.M. Amabile, B. Hennessey and E. Tighe (1994) was used. This inventory was developed to assess individual differences in intrinsic and extrinsic motivation orientations. The WPI includes the elements of intrinsic motivation (e.g. self-determination, competence, task involvement, enjoyment, and interest). The WPI includes 30 items that employ four Likert responses (4 = always or almost always true of you; 3 = often true of you; 2 = sometimes true of you; and 1 = never or almost never true of you). Reversed scores items were 9 and 14. The inventory has two versions: students' version and workers' version. The students' version was implemented in this study. Fifteen items that assess IM (Intrinsic Motivation) only analyzed.

To assess students' ability in solving problems creatively, the researchers developed a test that includes various problems from the Arabic Language, Science, and Social Studies curricula of 10th-grade. The stated problems are: (1) derived from the schools' curricula contents; (2) offer opportunities for students to see them from different angles; (3) ill-defined problems; (4) open-ended problems; and (5) real problems that exist in reality for the students.

Novelty and appropriateness were the criteria of judging creative production, because they are most conceptual definitions of creativity. Further, with the emphasis on assessing the creative product, these two criteria are widely recognized. In this test, novelty is the degree to which the idea is new, unknown in the field, and not included in the subjects' context, while appropriateness is the degree to which the idea is feasible and possible to use. Judging of responses was within the scale with four points. According to the power of each response, the judges give points from 0 to 4 for each element of novelty and appropriateness. All responses to the problem are judged by the three teachers of each subject, because they are experts in their field and they are knowledgeable of what is new in the various topics. The trainee teachers scored the responses after giving them an extensive course in conceptualization of problem-solving and creative responses, in addition to detailed information about novelty and appropriateness as criteria for creative production in the problem tasks.

FINDINGS AND DISCUSSION

Intrinsic motivation was associated significantly and positively with all of the dependent variables. It correlated moderately with novelty ($r = .324^{**}$, $p < .01$); 10.49% of the variation in common shared between these two variables. Intrinsic motivation also was associated significantly and moderately with appropriateness ($r = .306^{**}$, $p < .01$); 9.36% of the variation in common shared between these two variables. Additionally, intrinsic motivation and total score of the PST (Problem-Solving Test) were associated significantly and moderately ($r = .363^{**}$, $p < .01$); 13.17% of the variation in common shared between these two variables.

Specifically, novelty, appropriateness, and total score of PST were mildly associated to the intrinsic motivation. It means that the intrinsically motivated students tended to generate novel and appropriate ideas, and scored well in PST. Moreover, a positive association indicates that an increase or decrease of one variable, the other variable takes the same orientation. According of the result, null hypotheses H_1 was rejected.

Table 1:
Correlation Coefficients between Psychological Traits and Problem-Solving Abilities

	Novelty	Appropriateness	Total PST
Intrinsic Motivation	.324(**)	.306(**)	.363(**)

**Correlation is significant at the 0.01 level (2-tailed).

The creative-cognitive abilities based attribute models are not sufficient to explain students' creativity potential (Amabile, 1990). Intrinsic motivation related significantly and positively with creative production on problem-solving. This finding is consistent with the following studies. T.M. Amabile (1982) revealed that students with no-reward conditions told more creative stories than rewarded students; a study by R. Koestner *et al.* (1984) revealed that intrinsically motivated students were more creative in paintings than others. In the same context, T.M. Amabile and U. Brandies (1985) investigated that poems written by intrinsically motivated students were more creative than those written by extrinsically motivated students. K.M. Sheldon's study (1995) found that participants high on the creative personality scale and in problem-solving had greater orientation motivation, self-concept, and autonomy. A study by K. Seth (1995) investigated the differences in the subjective experiences of people at different levels of intrinsic motivation in solving problems creatively.

In the current study, one possible reason for the positive, significant relationship between intrinsic motivation and problem-solving is the fact that problems provided in the test were real, so that students felt and coexisted with them in their lives. Consequently, those real and vital problems stimulated them intrinsically to find novel and appropriate solutions. Intrinsic motivation strengthens and drives the people to find creative solutions to the problems (Hennessey, 2000).

Another explanation of the relationship was that intrinsic motivation raised the students' challenge and risk-taking (Deci & Ryan, 1985). In this regard, the problems provided were ambiguous, ill-defined, and infinite solutions might have been provided. Consequently, intrinsic motivation enabled students to challenge an ambiguous situation and generate new, accurate, feasible solutions to diverse problems. At the same time, students felt independent in creating solutions and this situation forced them to create ideas that differ from what they have already learned. They also wanted to see the consequences of their trials. Intrinsic motivation conducted students to concentrate on the task and focus their attention on finding solutions without the distraction of constraints (e.g. evaluation, praise, and rewards) as cited by T.M. Amabile (1990).

Table 2 shows the multivariate tests. School type has significant main effect on the linear combination of novelty and appropriateness, $F = (9.623)$, $df = 362$, $p = .00$. In contrast, there were no significant main effect of gender on the linear combination of novelty and appropriateness, $F = (2.815)$, $df = 362$, $p = .06$.

Table 2:

Multivariate Tests of the Novelty and Appropriateness based on Gender, School Type, and the Interaction between Gender and School Type

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
School Type	Wilks' Lambda	.950	9.623(a)	2.000	362.000	.000	.050
Gender	Wilks' Lambda	.985	2.815(a)	2.000	362.000	.061	.015

Main effect of school type on the appropriateness was significant (.010), with low effect size ($\eta^2 = .13$). The urban schools participants scored higher with average mean ($M = 23.8900$) than rural schools' participants ($M = 22.2216$), but there was no significant main effect on novelty (.099) with average mean of urban schools' participants ($M = 23.2750$), and rural schools' participants ($M = 24.3473$). The main effect of gender was not significant for neither novelty nor appropriateness. The average means of male and female on novelty were ($M = 23.6687$) and ($M = 23.8382$) respectively, and their average means on appropriateness were ($M = 23.8466$) and ($M = 22.5588$) respectively.

In summation, the main effect of school type was significant, Wilks' $\Lambda = .950$, $F(2,36) = 9.623$, $p = .00$, multivariate $\eta^2 = .050$. This means that the linear combination of novelty and appropriateness differed on the basis of rural and urban schools. In contrast, the main effect of gender was not significant, Wilks' $\Lambda = .985$, $F(2,36) = 2.815$, $p = .061$, multivariate $\eta^2 = .015$. This finding indicates that the linear combination of novelty and appropriateness were not differed with respect to male and female students. Based on this result, null hypothesis H_2 was rejected.

On the Gender and Novelty. One explanation of no significant difference in novelty with respect to gender is that both (male and female) students realized that the problems were real and had influenced on their life-styles, so they were encouraged to find new solutions. Another possible explanation could be that students had thought of the problems before and already had some ideas about how to solve them. Consequently, they found the test was an opportunity for them to provide their novel solutions.

Other possible interpretation is the essence of test that required novel, new, not routine ideas that prompt the students struggling to find new solutions for all of the problems. Moreover, the quality of provided problems inclined the students imagination to evoke, this process probably construct analogies between stated problems and some of the natural phenomenon. It is well known that brains in the creative process automatically move through many hints that illuminate in the brain. How the individual appreciate the hints and correlate them cognitively with the problems influence on their abilities to provide novel and original solutions. Other studies, for example from K. Fotis and MGeorgia (2009); and W. Niu and D. Liu (2009), made contradictory findings.

On the Gender and Appropriateness. No significant differences in appropriateness with regard to gender could be interpreted as the problems were real and reflected the lives of both male and female students. The problems are extent in the students' environment. Certainly, the observing of the problems sustained the students to develop consistent and feasible solutions. Moreover, this result is in line with the finding of no differences between male and female in novelty. This shows novelty and appropriateness are close to each other. Their convergence in age and mental age might be one explanation for the finding.

The possible explanation is the problems are not well-defined nor abstract problems, instead they are practical problems and discussed regularly in

the media, news, and people conversations. Furthermore, the researchers emphasized that feasible, appropriate solutions must be provided, instead unrealistic ideas are ignored. Then students concentrated their attention on the problems to provide real solutions. This finding is consistent with study findings by S. McCloy (2005), but contradicts the study by P. Dolores *et al.* (2006).

On the School Type and Novelty. There were no significant differences in novelty with regard to school type. One explanation is that the researchers stimulated students to generate new ideas, and he/she emphasized that traditional or known ideas stated in the curricula were not welcome. Moreover, he/she gave them freedom to generate ideas regardless of the cost or whether it needs time to be useable. Thus, students found that the problems were not easy and they request novel ideas, certainly such nature of the problems encouraged them to generate new ideas.

The other possible of the result refer to the similar learning environment that students share. There are no significant differences in the instructions, subjects, and evaluation system. The learning environment similarity affects on the students' cognitive style and the studies habits. Moreover, in parallel with the problems' essence, the all students appreciate the problems through studying them in the subjects or by observing them in their environment; therefore, they prompt to generate new ideas that may contribute to solve the problems. Clearly, the students felt that the provided solutions to the problem are not satisfied, wherefore the other possibilities are required.

On the School Type and Appropriateness. Urban students scored higher on appropriateness than rural students. This result was expected because the urban students were well informed with all the available solutions to the problems, since they live in the cities where the latest inventions are available. In contrast, students in the rural areas may do not know about most of the modern inventions, because they take longer to reach their areas. In addition, the urban areas are rich environments that have witnessed more alternative solutions compared with the rural areas which are conservative. The other possible reason is that students realized that it is very important to contribute to solving the problems as they are directly related to their lives.

The other possible explanation is urban students may be most fearless in giving creative solutions than rural students who tend to solve the problems with procedures learned and know. Courage of the urban students prompted them to provide creative ideas that rural students realized them virtual or unrealistic. A study by K. Gustafson (2002) revealed no significant differences between urban and rural students in appropriateness.

Hypothesis H_3 which was measured by simultaneous multiple regression approach. Combination of three factors (intrinsic motivation, gender, and school type) was statistically significant $F(5, 36) = 19.98, p < .00$ on prediction of total score of Problem-Solving Test (PST). The model summary in table 3 shows that the multiple correlation coefficient (R) for all predictors simultaneously is .466 ($R^2 = 21.7$) and the adjusted R^2 is 20.6, which means that 20.6% of variability

in total score of PST was accounted for by the factors of intrinsic motivation, gender, and school type.

Table 3:
Model Summary of the Variability in TTCT Based on the Predictors

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.466(a)	.217	.206	9.46593

As displayed in table 4, only two factors (i.e. intrinsic motivation and gender) were contributed significantly to the total score of PST (Problem-Solving Test). Intrinsic motivation had the most contribution, the beta weight was $\beta = (.232)$, $P < .05$, and gender $\beta = (-.0112)$, $P < .05$ sequentially. In contrast, school type was not. School type beta weight was $\beta = (-.076)$, $P > .05$. As a result, model of regression was failed to reject hypothesis H_3 .

Table 4:
Coefficients for the Two Combinations of Predictors on Total Score of PST

Model		Unstandardized Coefficient		Standardized Coefficient		Collinearity Statistics		
		B	Std Error	Beta	T	Sign	Tolerance	VIF
1	(Constant)	4.378	6.485		.675	.500		
	School Type	-1.620	1.012	-.076	-1.601	.110	.962	1.040
	Gender	-2.384	1.005	-.112	-2.373	.018	.980	1.021
	Intrinsic Motivation	.387	.088	.232	4.401	.000	.783	1.277

On the Prediction of Intrinsic Motivation on Total Score of PST. The findings revealed that intrinsic motivation predicted the total score of PST (Problem-Solving Test). One interpretation of the positive relationship is that intrinsically motivated students were knowledgeable about their real life problems. “A person with a strong interest in a topic can be encouraged to master facts, principles and procedures as a final objective or to view such knowledge and skills as a basis of innovation” (Eisenberger & Shanock, 2003:128). The students’ performance goals were oriented towards problems such as the desire to demonstrate high ability that can lead to higher motivation. T.M. Amabile and N. Gryskiewicz (1989) asserted that the sense of challenge fuels creativity and that often comes from the intriguing nature of the problem itself. Moreover, as real problems, students were motivated to change the direction of solving them because they knew that new and novel solutions not provided yet.

Other studies have produced similar findings. T.M. Amabile, B. Hennessey and H. Grossman (1986) revealed that intrinsic motivation and curiosity

predicted creative performance in problems of storytelling. A study by P. Tierny, S.M. Farmer and G.B. Graen (1999) revealed that intrinsic motivation predicted the employees' creative production in leadership. Moreover, a study by K. Jeon (2008) scrutinized how situational interests significantly predicted creative performance in mathematical problems. Further, M. Ann (1990), in her experimental research, found that positive informational feedback sustained intrinsic motivated people to face controlling aspects or negative competence information. The childrens' perceptions of autonomy in the classroom were positively related to creative performance in essay activities.

On the Prediction of School Type on Total Score of PST. School type as a dummy variable did not contribute to the equation of total score of PST (Problem-Solving Test). This finding may refer to the existence of the all provided problems in urban and rural environment. Therefore, all of the students recognized them and appreciated the importance of solving them from different perspectives. Another reason is that the students study in similar school environments, and study same curricula, and the instructional methods are not differed.

Another possible explanation is that the students are in different environments and do not have experience of solving real problem before, because they have to follow the systems of implementing the curricula without giving more concerns of environmental problems. This finding raises the question of whether the curricula contain a real problem, so that they make sense to the students. Furthermore, how much freedom was given to teachers to make students find the problems which make sense to the subject content from their particular environment? The negative answers to these questions might be reasons for the current finding.

On the Prediction of Gender on Total Score of PST. Gender as a dummy variable contributed to the equation of total score of PST (Problem-Solving Test). This finding may have resulted from the variety of this variable, because females consisted of 55.6% of the sample. Another reason is the difference among students involved in solving problems and how much they were concerned to solve them in different ways. A further reason relates to the nature of males and females in Omani society. In general, real and other problems are normally tackled by the males who are enable to see the problems from the different angles. In contrast, females are limited to solving community and real problems.

The other explanation refers to the personality of females that were slight likely to follow the instructions than males. They tend to solve the problems consistently with the given procedures; in contrast, males tend to solve problems on their own. Moreover, boys tend to have much prowess to provide creative ideas than girls. As much as alternative ideas are provided the probability of finding novel and appropriate ideas is increased.

CONCLUSION

Implications of the study's findings could be influence on the policy makers' efforts of conceptualization the creativity. Creative thinking is not an easy work; it needs perseverance, persistence, and risk-taking that provided as much as the tasks were interesting and enjoyable. The contents' activities must interesting and reflect the students' concerns. In addition, the provided problems of students must be ambiguous and real problems that provoke the students' enthusiasm and willingness to tackle the problems and solve them creatively.

Teachers in the classrooms could cultivate intrinsic motivation among students by providing opportunities for them to find problems through the subjects' contents, situations, and devices, etc. When students find the problem, they will automatically be stimulated to find the solutions. Moreover, through the learning process, teachers try to find out learners' interests and relate to them with instructions. Wise teachers are knowledgeable of what learners find interesting. Present study offer great opportunity to conduct researchers to investigate relationship of other personality traits with creativity

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Scale of Judging the Novelty in Problem-Solving Test

Description	Score
The idea is totally new. Quite sure that I haven't heard about it before. I'm sure that it isn't exist yet. None has created it so far. Very impressive. Great.	4
The idea is roughly new. I think it is not exist. It draws attention to the reader. It is quite new according of the students' mental and age. Sustainable.	3
The idea is normal. It is exist and stated before. It is roughly new according of the students' mentality and age. Known to the most of people.	2
The idea is quite normal. The students have heard about it. Known to the people. Most of people don't use it now.	1
The idea is traditional. Old. People already don't use it.	0

Scale of Judging Appropriateness in Problem-Solving Test

Description	Score
The idea is well suited to the problem. It doesn't need to be amended or neither adaptations nor additions. Applicable. Specifications of implementing are quite clear. Very effective.	4
The idea is suited to the problem. It needs simple adaptations and additions. Can be applied after simple amendment. Fairly effective.	3
Idea somewhat related to the problem. It needs many adaptations and additions. It needs further adaptations before application. Specification of application is not clear. Normally effective.	2
The idea is not related to the problem. Needs many adaptations and additions. It seemed neither feasible nor effective. It hasn't a value.	1
The idea is far from the problem. It is neither effective nor feasible.	0