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AN EXAMINATION OF THE EFFECTS OF A PROCESS-BASED THINKING MODEL ON COMPREHENSIVE REFLECTIVE THINKING

(SÜREÇ TEMELLİ DÜŞÜNME MODELİNİN KAPSAMPLI YANSITICI DÜŞÜNME ÜZERİNDEKİ ETKİLERİ HAKKINDA BİR İNCELEME)

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ABSTRACT

The purpose of this research is to examine the result of the process-based thinking model conducted in a workshop on the Comprehensive Reflective Thinking (CRT) of university students. The method of research was experimental with the use of control and experimental groups. The research included pretests and posttests. The statistical population was comprised of students from the University of Sistan and Baluchestan (USB). The subjects were selected randomly from voluntary students who were matched in the two experimental and control groups. The students of experimental group participated in a ten-session workshop. The instrument used for gathering the data was a Comprehensive Reflective Thinking Scales (CRTS). Statistical analysis was conducted by the analysis of covariance method. Results show that the CRTS scores for the experimental group were significantly higher than the CRTS Score for the control group. There were no significant differences between the CRTS scores of boys and girls. But the interaction of gender within the groups shows that the CTRS scores for males in the experimental group are significantly higher than for males in the control group.

Keywords: Thinking, comprehensive, reflective, process-based thinking model, and student.

ÖZ

Bu çalışmanın amacı, üniversite öğencileriyle kapsamlı yansıtıcı düşünme konulu yürütülen bir çalıştayda kullanılan süreç-temelli düşünme modelinin sonuçlarını incelemektir. Bu bağlamda, çalışmanın yöntemi deney ve kontrol gruplarının kullanıldığı deneysel yöntem olarak belirlenmiştir. Çalışmada ön ve son testler de uygulanmıştır. İstatiktiksel evreni, Sistan ve Baluchestan Üniversitelerinde okuyan öğrenciler oluşturmuşlardır. Katılımcılar, gönüllü olan öğrenciler arasından gelişigüzel bir şekilde seçilerek deney ve kontrol gruplarına yerleştirilmiştir. Deney grubundaki öğrenciler toplam on seanslık bir çalıştaya katılmışlardır. Veri toplamak için, kapsamlı yansıtıcı düşünme ölçekleri kullanılmıştır. Toplanan veriler istatistiksel açıdan kovaryans yöntemi ile analiz edilmiştir. Elde edilen bulgular, ölçek sonuçları bağlamında, deney grubundaki katılımcıların kontrol grubundakilere göre istatistiksel olarak daha yüksek skorlar elde ettiğini göstermiştir. Cinsiyet değişkenine göre ise erkek ve kadın katılımcılar arasında istatiksel açıdan önemli bir fark ortaya çıkmamıştır.

Anahtar Sözcükler: kapsamlı yansıtıcı düşünme, süreç-temelli düşünme modeli ve öğrenci

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INTRODUCTION

John Dewey rationalized that reflective thinking is the central process through which learning from experience takes place (Halton, Murphy and Dempsey, 2007). However, in many of countries, the main aim of education is the transmission of knowledge (Glevey, 2006). Spatially, the educational systems of Developing Countries are subject centered. The main aim of these educations is the transmission of knowledge (Shariatmadari, 1995). Students often "use words and ideas, but they do not know how to think ideas through and internalize foundational meanings" (Commander, 2003: 23). Therefore, one of the main duties of educational institutions is to concentrate on improving students' thinking skills. The enhancement of thinking is at the heart of educational policies for some national governments in order to increase the educational standards. For example, in England, teaching thinking has become a part of the school curriculum (Glevey, 2006). Reflection has considerable power and potential for teachers' professional development (Husu, Toom and Patrikainen, 2008). Improving critical thinking is also endorsed in higher education (Allegretti and Frederick, 1995). Mazer, Hunt, and Kuznekoff (2008) argue that critical thinking is a lifelong skill for students and crucial for their development.

Studies indicate that students' thinking abilities can be enhanced through direct instruction (Worsham and Stockton, 2008). For example, Plath, English, Connors and Beveridge (1999) study showed that teaching critical thinking skills improved the critical thinking abilities in students of social work and assisted them to identify principles of critical thinking. Kazemi (2000 *b*) indicated that reflective thinking was improved by using of "problem solving method of teaching" in students of secondary school at social studies classes. Osburn and Mumford (2006) reported that training in the application of effective strategies promoted the creative problem-solving skills of students. Generally, Zhang (2008) showed a mutual effect between the teaching ability of instructors and student development.

A number of studies investigated the relationship among improvement of thinking and others characteristics of subjects. For example, Gilstrap and Dupree (2008) found academic achievement, gender, semester, and year in school as significant predictors of critical reflection. Markman and McMullen (2003) argued that reflective thinking is enhanced by thinking about the self and the standard together, as it is prompted when the inclusion of information about the standard in self- construal is simulated. They mentioned, also, that reflective thinking is likely to be improved by the clear prospect. Vincent, Decker and Mumford (2002) indicated that intelligence and expertise enhance creative problem solving. Zhang (2008) studies relationship between thinking styles and identity development among Chinese students. He used the

Thinking Styles Inventory (grounded in Sternberg's theory of mental self-government), and the Erwin Identity Scale (based on Chickering's theory of psychosocial development). He concluded that thinking styles strongly predict identity development. Phan (2008) showed that reflective thinking was predicted by epistemological beliefs and learning approaches. On the other hand, Charles and Runco (2001) indicated that the accuracy of the originality judgments was not associated with divergent thinking. That is, increasing concentrate on correct ideas predict decreases in the proportion of high-quality round ideas given. A possible explanation for this unexpected finding is that the accuracy needs external evaluation and Amabile (1996) explained that external evaluation limits creative thinking. Runco, Dow and Smith (2006) concluded from a study a wonderful result that sometimes divergent thinking is related to an individual's knowledge; also it is sometimes not connected to knowledge. Accordingly, the studies showed that thinking development is related to academic achievement, gender, self- construal, intelligence, expertise, identity development, epistemological beliefs and learning approaches.

Other scholars tried to suggest effective programs or models for the enhancement of thinking skills. One of these scholars was Edward De Bono (1972) that developed the Cognitive Research Trust (CORT) to teach children general thinking skills. De Bono (1999) created a model of thinking and called it the "Six Thinking Hats". He identifies six types of thinking, each distinguished by a different colored hat. For example, Red Hat used feelings, emotions and intuition when thinking about a topic. Putting on each colored hat facilitated different thinking skills because they focus one's attention on generative thinking, creative, objective information, logical negative thoughts, logical constructive thoughts, emotions and thinking process (Walter and Carl, 1995). The majority of students that participated in this reflective approach to teaching and learning felt it was a unique experience which helped them discover their own learning style and influenced their ways of thinking and constructing knowledge (Halton, Murphy and Dempsey, 2007). Allegretti and Frederick (1995) claimed that the Toulmin, Rieke, and Janik's critical thinking model helps students to examine evidence comprehensively and to consider the broader implications of their opinions. De Corte, Verschaffel and Masui (2004) introduce the CLIA model (Competence, Learning, Intervention, Assessment) as a framework for the design of learning environments and one of its aims was the facilitation in thinking skills. As part of revisions to a university's program, Mazer, Hunt, and Kuznekoff (2008) investigated the effectiveness of a model containing enhanced instruction in critical thinking in a basic communication course. This research revealed that this new instructional model improved the critical thinking skills of students. However, Glevey (2006) maintains that over the past decades, there is no clear evidence to support the effectiveness of these special thinking skills programs that

developed to improve thinking and Mazer, Hunt, and Kuznekoff (2008) argue that future research should concentrate on enhancing the critical thinking of students. Therefore there are not systematic and holistic methods to improve thinking skills. In this study, a process-based thinking model was created to improve the Comprehensive Reflective Thinking (CRT) skills of students according a theoretical framework. This model and the scale used in this study are based on the following theoretical framework.

THEORETICAL FRAMEWORK

In spite of the position that argues the concept of reflective thinking is not clear (Husu, Toom and Patrikainen, 2008) and it is difficult to formulate thinking because by thinking we experience in various ways that require different formulations of thinking (Glevey, 2006); there is a generalist position that maintains that thinking in different experiences is evoked by facing to a problem and continues through resolving the problem by available information and it make no difference whether the problem is about sending a rocket into space or riding a bicycle.

According to this point of view, reflective thinking includes many thinking concepts like critical thinking, creative thinking, decision making, diversion and conversion thinking and problem solving methods (Gilhooly, 1990, Bensley, 1998, Lumsdaine and lumsdaine, 1995, Plath, English, Connors and Beveridge, 1999, Vincent, Decker and Mumford, 2002, Glevey, 2006 and Wu, Shiu, and Chiou, 2008). For example, Ennis defined critical thinking as "reasonable reflective thinking that is focused on deciding what to believe or do". He emphasized that this definition includes creative thinking and decision making (Plath, English, Connors and Beveridge, 1999: 208), Vincent, Decker and Mumford (2002) found that creative problem solving is effected by divergent thinking and Glevey (2006) argues that there are very close connections among the different types of thinking. Wu, Shiu, and Chiou, (2008) revealed that dialectical and relativistic thinking were positively related to creativity. Along similar lines, this process of thinking involves all kinds of concepts that refer to thinking. That is, all types of thinking concepts pass through similar stages in the following way: 1) clarifying a problem, 2) information gathering, 3) proposing a hypothesis, and 4) an examination of the hypothesis (Dewey, 1933, Smith and Hullfish, 1992, Shariatmadari, 1995, Sternberg, 1989 and Kazemi, 2000$_a$). Therefore reflective thinking involves creative thinking, critical thinking, decision making and so on.

Philip G. Smith (cited by Shariatmadari, 1997) described reflective thinking /Philosophic thinking as comprehensive (coherent), deep and flexible thinking. Nevertheless, when these characteristics are analyzed, it becomes clear that deep understanding and intellectual flexibility are a result of

comprehensiveness. That is, when someone wants to think in a deep way, he/she has to consider more peaces of information that support a reason. So, he/she thinks more comprehensively to obtain this level of thinking. In the same way, intellectual flexibility (the number of categories in ideas) needs to consider new categories of information, which results in comprehensive information. If intellectual flexibility can be described as the implementation of thinking results (Ibid), it is a moral concept that is different from cognitive thinking. Similarly, Lipman (cited by Parirokh, Fattahi, Parirokh and Majdi, 2006) maintained critical thinking used excellent judgment where everything relevant was taken into account. Therefore, in the present theoretical framework, comprehensiveness is the main criterion for reflective thinking. In keeping with this observation; in this study, "comprehensiveness" was attached to the phrase of "reflective thinking".

The definition of the CRT used for the purposes of this study is the one used by Yahya Kazemi in his Ph.D. dissertation. Kazemi (2000$_a$: 20) defines reflective thinking as "an attempt to clarify a problem, seeking information and finding a reasonable and *comprehensive relationship* among the separated pieces of information by reorganizing them via the use of fantasy to create a hypothesis". This definition is focused on the process of thinking and the best outcome of this process is a hypothesis that explains comprehensive relationships. In this definition, finding the comprehensive relationship expands reflective character of thinking. That is, when an Idea is more reflective that it supported by a more comprehensive informational system. For example, a hypothesis is more reflective when it is confirmed by several theories, in comparison with a hypothesis that is supported by only one theory.

This theory is also supported by philosophic and physics cosmologies that coherence and unity are the main idea in their views. For example, Hegel said that the reality is the rational (Minogue, 2000); the Absolute or God, as an integrated whole, has no fault, no antithesis and no conflict (Shariatmadari, 1993: 226). Pantheistic philosophers argue that in the deepest analysis, there is a unique thing of which all things are parts. The thing of which all things are parts is divine (Oppy, 1997). Spinoza holds that there are no substances distinct from God (Oakes, 1997). Findings of physics also, indicated that the universe is made of atoms. The diversity of the apparent universe such as trees, and stones are made of one substance, atoms. In a deeper analysis, it consists of energy and waves. Wu (2004) cited that the quantum state of the universe is described by its wave function. In the no-boundary universe, the wave function is defined by the path integral over all compact manifolds with the argument of the wave function as the only boundary. Gousheh and Sepangi (2000) argue that the resulting wave packets can be considered as coherent states in quantum cosmology. Therefore, for discovering of coherence and unity, we need to comprehensive thinking skills.

Apart from this, a process-based thinking model was invented to improve CRT in the current study. This model is based on the process of thinking. In other words, it focused on the four stages of thinking mentioned above. In addition, it focuses on emotional obstacles that restrict the CRT.

An outline of the process-based thinking workshop evaluated in the study

The workshop was conducted in ten sessions. In each session, students practiced one of the problem solving stages. At first of each practice, students worked individually on the given problems, and then they shared their ideas with a small group (3 to 4 members) to revise their previous ideas. In the final session, group work was omitted because the subject of that session was private. If someone was weak in one of the stages, he/she was persuaded to practice that stage out of workshop time. The guidelines of this process-based thinking workshop have been outlined in the following stages:

- Motivational lecture: what is the importance of thinking in terms of scientific, economic, social and historical development? Why do some people use fewer thinking skills? How do we enforce thinking?
- Thinking, with the aim of clarifying the stages of thinking: How does thinking begin? How is a problem resolved? How is a resolution approved?
- Changing the use of fantasy to guessing: A) write 10 sentences that are impossible. B) Fill the unfinished sentences, rationally and realistically.
- Thinking, with the use of the Hypothesis Making Tools (HMT): write all the possible resolutions to the presented problems. Use Brain Storming (Lumsdaine and Lumsdaine, 1995: 198, Torrance, 1993: 46), Loud Thinking (by writing) and Considering a Sample when thinking (kazemi, 2000_{a}: 112) tools.
- Thinking, with the aim of choosing the best hypothesis: give all of possible resolutions to the presented problems, then chose the best one by ranking the resolutions.
- Thinking, with the aim of using the Information Gathering Tools (IGT): use PMI (Plus, Minus and Interesting Points), OPV (Other People's Views) and C&S (Consequence and Sequence) tools (Maclure and Davies, 1989) when thinking about critical problems like "what do you think about paying to study in public universities?"
- Thinking, with the aim of clarifying a problem: write all the problems you know of, and then choose the most important one by using the IGT.
- Thinking, with the aim of clarifying and dividing the emotional impacts: with your different problems, how can you separate the

emotional effect from rational thinking? Chose the best proposition offered from the group and try it in real situations (after the session).

- Thinking, with the aim of combining the different stages of thinking: A) Write all your local cultural problems and then choose the most important one by using the IGT. B) Write all the possible resolutions to the chosen problem by using the HMT, and then choose the best resolution.
- Thinking: individually, write down all your private problems and then choose the most important one by using the IGT. Write all the possible resolutions to the chosen problem by using the HMT, and then choose the best resolution.

This study investigated the effect of the workshop, based on processed-based thinking model on the CRT (Comprehensive Reflective Thinking) skills of students.

METHODOLOGY

To increase the accuracy of the CRT model, it was conducted on 18 students similar to the subjects, as a pilot study. The CRT scale administrated on these students as pretest and posttest.

Experimental design

The study employed a pretest and posttest experimental design with an experimental group and a control group. The subjects were matched in two groups according to their results in the pretest of Comprehensive Reflective Thinking Scales (CRTS). These were administered to 68 volunteer students when they enrolled for the workshop. Each group was assigned randomly to control or experimental group. Only the students in the experimental group participated in the workshop. The workshop ran for twenty hours over three weeks (ten sessions). During this time the control group was waiting for the next workshop[i]. Post-tests using the CRTS were administered at the end of the workshop for both groups. Results of the experimental and control groups were compared using the statistical method of analysis of covariance (ANCOVA)**.** In addition, the subtraction of pretest from posttest were obtained (changes from pretest to posttest) and mean scores reported by it for simplification.

The design of the research can be presented as follows:

O_1 M R $\longrightarrow$ X $\longrightarrow$ O_2 — Experimental Group

O_1 M R $\longrightarrow$ Y $\longrightarrow$ O_2 — Control Group

O_1—pretest, O_2—posttest, M — matched by result of pretest, R — random assignment, X—participate in the workshop, Y—none participate in the workshop.

The statistical population consists of 21217 undergraduate and postgraduate students of University of Sistan and Baluchestan (USB).

The sample was comprised of 40 subjects that were selected randomly from 68 volunteer students who wanted to participate in the "promoting thinking workshop". The volunteer students were females and males from various fields of study. They knew of the workshop because it was displayed on notice-boards at all USB faculties.

Table 1. The Sample Size of Subgroups

Group	Gender	N
Control	females	8
	Males	12
	Total	20
Experimental	females	9
	Males	11
	Total	20

Research Instrument

The instrument used in this research was the Comprehensive Reflective Thinking Scale (CRTS). Kazemi (2000$_a$) developed a scale for measuring CRT as Comprehensive Reflective Thinking Scale (CRTS). This scale contains three subscales that examine "comprehensiveness" of thinking. This instrument was developed from the divergent thinking test that created by Guilford. It contains open-ended questions where the respondents are asked to create as many possible solutions or ideas. Scores with the divergent thinking test are based on three subscales: ideational fluency (the total number of ideas), originality (the number of unique or unusual ideas), and flexibility (the number of categories or themes in the ideas) (Osburn and Mumford, 2006). Two subscales of the divergent thinking tests are similar to the subscales of the CRTS. The third subscale, (originality) is used to examine creativity so it

is omitted from the CRTS and instead; credibility (the number of reliable ideas) is added to the subscales. When scoring, if an idea is not credible, it will be omitted from scoring in all subscales.

This scale contains open-ended questions that with two parts. The first part of each question has a short-answer. The second part has a tag attached to each question and the respondent is asked to generate a number of rationales for supporting the first part /short-answer/. The second part of the question is used to assess of Comprehensive reflective thinking. The questions are about different social subjects; for example: What is your best way for becoming friend with an alien? "Why? (Please write all your ideas that support it.)" There are three subscales for this assessment: 1) fluency or the total number of ideas (in scoring, one point is given for each idea or reason), 2) flexibility or the number of categories or themes in the ideas, (in scoring, one point is given for each category from which the ideas or reasons are extracted), 3) creditability or the number of reliable ideas (in scoring, one point is given for each reliable idea or reason - Each idea or reason that is not reliable is omitted from the scoring). Kazemi (2000$_a$: 123) reported that formal validity of the questions was confirmed by three educational experts. Validity and reliability was also achieved by the Factor Analysis so that six questions remained out of the eight. For these six questions the coefficient of Cronbach alpha reported was .71. In the present study the alpha was .72 (N= 65, Items= 6).

To increase reliability of this open-answer test, the scoring is executed by 3 examiners that the correlations among their scoring were r =.65, .68 and .73 (sig. = 00).

RESULTS

The result of pilot study was very desirable and a huge increasing in the student scores was showed. The score of some students increased fivefold.

Levene's Test of Equality of Error Variances showed that the error variance of the dependent variable is equal across the groups, $F(3,36) = 1.23$, $p \geq .05$. Therefore, ANCOVA was performed. Results of the CRTS of experimental and control groups were compared, outcomes summarized in Table 2, below.

Table 2. Summarized results of the changes obtained by effects of the workshop on the CRTS of students

Source	Sum of Squares	Mean Square	F	Partial Eta Squared
Pretest	5306.99	5306.99	**20.97	.37
Group	1176.83	1176.83	*4.65	.12

Gender	1.34	1.34	.00	.00
Group * Gender	1331.95	1331.95	*5.26	.13
Error	8856.97	253.06		
Total	185694.00			

R Squared for the groups, gender, and their interaction = .230 (Adjusted R Squared = .166).
Dependent Variable: posttest of the CRT.
df(1,35) **P≤ 0.01 *P≤ 0.05

Table 2 shows that there is a significant difference between the CRTS scores of the control and experimental groups, $F(1, 35) = 4.6$, $MSE = 1176.83$, $p \leq .05$. That is, the mean score of changes for the experimental group, $M = 15.2$, $Sd = 17.8$, is significantly higher than the mean score of changes for the control group, $M = 2.8$, $Sd = 14.7$.

Table 2 also reveals that in general, the mean square of change of the CTRS scores for males and females is not significantly different, $F(2, 21) = .005$, $MSE = 1.34$. That is, in the both groups, control and experimental, changes of the CTRS scores for males and females were equal. But the interaction of gender within groups exhibits a significant difference $F(1,35) = 5.26$, $MSE = 1331.95$, $p \leq .05$. When comparing gender within the two groups, the mean scores of change of the CTRS for males in the experimental group, $M = 18.9$, are significantly higher than for males in the control group, $M = -2.4$. The mean score of change of the CTRS was 10.8 for females in the experimental group and 10.4 for females in the control group.

When using the Adjusted R Squared method the results show that .166 of the CRTS variance is predicted by the group's gender and their interaction.

DISCUSSION

This study examined the effectiveness of a process-based model on the CRT (Comprehensive Reflective Thinking) skills of university students. The model was used in a workshop that lasted ten sessions. The results of this research revealed significant improvements in students' CRT skills in the experimental group compared with the students in the control group. In other words, the process-based model enhances the CRT skills of students.

These findings support the results of other studies which demonstrated that the thinking ability of students can be improved through direct instruction (Plath, English, Connors and Beveridge, 1999, Kazemi, 2000 *b*, Osburn and Mumford, 2006, Worsham and Stockton, 2008 and Generally, Zhang, 2008). The previous researches did not clarify their theoretical foundations about

thinking skills (De Bono, 1972, De Bono, 1999, Halton, Murphy and Dempsey, 2007, Toulmin, Rieke, and Janik cited by: Allegretti and Frederick, 1995, De Corte, Verschaffel and Masui, 2004 and Mazer, Hunt, and Kuznekoff, 2008). They used chaotic models and studied fractional skills. On the other hand, the model used in this research is based on a rational framework that is approved by some great educational philosophers like Dewey (1933), Smith and Hullfish (1992), Shariatmadari (1995) and Sternberg (1989). These findings show that the theoretical process of thinking is one of the main sources for developing practical skills that improve CRT skills.

Another finding in this study shows that in general, changes in the CTRS scores for males and females were equal. Nevertheless, the interaction of gender and groups shows that the mean of change in the CTRS scores for males of the experimental group are higher than that for males of the control group. But the mean of change in the CTRS scores for females in the experimental group was equal to females in the control group. This finding revealed that the CTRS scores of females showed a substantial increase even in the control group. The latter result supports Gilstrap and Duprees' (2008) findings and, also, Tripp and Woods' (cited by Gilstrap and Dupree, 2008) argument that often female students are more comfortable with reflective and critical thinking than their male counterparts.

The results of previous correlation research that revealed, thinking is correlated with gender and some other demographic and personal variables (Gilstrap and Dupree, 2008, Markman and McMullen, 2003, Vincent, Decker and Mumford, 2002, Zhang, 2008 and Phan, 2008), extend information about dimensions that are influenced by thinking.

Conclusion

In this study we found that the process based thinking model can be an effective means for improving the CRT (Comprehensive Reflective Thinking) skills of students. However the CRT instruction should not be limited to a workshop and "this vital instruction should expand to content areas throughout students' academic careers" (Mazer, Hunt, and Kuznekoff, 2008); similar workshop would be an effective means for greatly improving the CRT (Comprehensive Reflective Thinking) skills of students.

These findings have implications for academic staff, teachers, and curriculum administrators. Accordingly, the program of improving of process-based thinking that is mentioned in the guidelines of workshop can be used to enhance Comprehensive Reflective Thinking abilities. Also, each of the stages that are mentioned in the guideline can be used, separately, when the students have more weakness in some of thinking stages.

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[i] In keeping morality observations, the students of control group participated in a similar workshop after conducting the research.