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# The impact of Information and Communication Technology (ICT) on learning styles (Kolb Model) in Smart Secondary Schools in Qom Province

**Fatemeh Jangholi ***

* Islamic Azad University (IAU), Islamshahr Branch, Islamshahr, Iran

* Corresponding author's Email: jangholi57@yahoo.com

**ABSTRACT:** The current study is intended to investigate into the impact of Information and Communication Technology (ICT) on Learning Styles (Kolb Model) for students in Smart Secondary Schools at Qom Province, Iran. This survey is of semi- empirical type along with pre-test and post-test. Sample Group of this study was selected by means of Morgan's Sample Size Table and calculation of loss coefficient with 353 participants via simple random technique; due to limited number of teacher, full- counting method was adopted to compute sample size. All students and their teachers from 5 urban regions answered to Kolb Learning Style Inventory (KLSI-2005) at pre-test stage. After 3 months and through adoption of Information and Communication Technology (ICT), the questionnaire was again distributed between statistical samples and gathered after responding. To analyze data, descriptive and inferential statistical methods were utilized (including dependent t-test, Cramer's V- Willcoxon Signed Rank Test). Research findings showed that application of ICT has changed mean scores of students in learning by means of Concrete Experience (CE) and Abstract Conceptualization (AC) at post- test stage ($p<0.05$); however, it had no significant effect on scores of Reflective Observation (RO) and Active Experimentation (AE) ($p>0.05$). Findings came from review of the impact of using ICT on divergent and convergent, assimilator and accommodator learning styles indicated that Information and Communication Technology (ICT) has managed to modify learning styles in students at post- test stage. Thus, it may be concluded that one can modify students' learning styles by means of ICT.

**Keywords:** Information and Communication Technology (ICT), Smart Schools, Learning Styles, Kolb's Method of Learning, Students

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## INTRODUCTION

Upon the emergence and development of IT phenomenon, the global changes are going to be expanded with more acceleration and through information and knowledge orientation. At present, it has passed more than 2 decades that this topic has entered into the field of training and education and at the same time it has also challenged training systems and educational environments. With respect to speed, expansion and depth of developments caused by technology, identifying the coordinates and parameters of this phenomenon and its mindful and smartly management may serve as one of the strategies taken by educational practitioners throughout this country and also as an opportunity to reconstruct training and education system and development in teaching and learning processes. At the beginning of Third Millennium, strategies of global community have caused ICT to play crucial role in realization of training and education system, particularly for learning. Therefore, by benefitting from tools and techniques, which have been created by this technology, one could provide learning conditions for different talents and tastes in addition to accelerating in training speed (Norouzi et al, 2003).

Education is the main cornerstone in Sustainable Development for any country and today E-learning is one of the newest, effective and confident ways in development of individual and organizational trainings, which have caused giving many services and developments in different fields of teaching and learning. About training and education, Howard Gardner states: "Since human's perception varies toward the world so children's mind should be filled with apprenticeship, projects and technology contents so that any student is able to accommodate himself/ herself to the given training (Gaits, 1999). By modifying educational methods, IT has led traditional meaning of "memory- based leaning" toward "creative and dynamic learning" (Jariani, 2001).

With respect to importance of learning subject, individual learning style is one of the characteristics (traits) of learner. Learning style is some part of personal differences. Learning styles, which are individuals' habits for processing received information, are considered as one of the effective factors on learning. Researchers argue that all learners adopt different preferred method for perception, organizing and storing information that are distinct and relatively stable.

Several reports, which have been published by some organizations like UNESCO, suggest that IT has caused exertion of several changes in learning process

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and with respect to variety of communities, humans, creativities and their interests, it requires the presence of variation in learning styles and this necessitates a new framework of teaching with sufficient flexibility in this regard (Haddad, 2007).

The results came from several studies have indicated that accommodation of training materials to meet different learning requirements for students may be useful to them and this requires us to identify learning styles and to know what kind of materials need for any style including this point that these styles which have allocated many studies to themselves are Kolb's four- sided learning styles where with respect to their increasingly applications, are growingly used for teaching and learning processes. The foremost characteristic of this theory is to emphasize on experiential nature of learning that differs from other cognitive and behavioral theories, which focus on role of mental experience in learning process (Kolb, 2005).

Thus, production of knowledge and optimal application of Information and Communication technology (ICT) in training and education process may increase students and teachers' knowledge and capability and it will contribute to Training and Education System in it paramount mission i.e. training of strong and efficient manpower more than past. Alternatively, the major part of social, moral and cultural and even economic problems of various countries is originated from underdevelopment and their leaving behind knowledge and technology convoy.

Today, experts in training and educational fields recommend that tactics and strategies are planned for design of curricula in such a way that they are able to bring up student as knowledge producer and maker and not exclusive as its receiver. In this course, at the beginning of the current century this slogan was raised that "The lesser is the greater" and this means "Transfer less knowledge and instead increase more technique of conceptualization and production of knowledge.

It is because of this fact that in order to convert knowledge into capability, it requires student to play more active role in learning process. In other words, learner should not suffice only to textbook and teacher's lecture to receive information since thereby he/ she could more rarely use his/ her teachings in new and real situations .Since technology toady serves as pivot for all activities and its impact has been certainly identified on all economic, educational, social activities so the present study tends to find the answer to this question that: Is Information and Communication Technology (ICT) effective on learning styles (Kolb's Model) for students of smart secondary schools from Qom Province in lesson of natural sciences(Kolb, 2005).

**MATERIALS AND METHODS**

Current methodology is of pseudo-empirical types of study in which learning styles of tested have been measured before and after application of ICT for 3months and their differences have been analyzed.

In this study, first statistical population includes: I) All students in Grade III at smart secondary schools in Qom Province; Iran, who have studied there during academic year 2011-12; namely, 1408 students totally. II) Second statistical population of this survey comprises of all female and male teachers, who have taught in Grade III at public and non- public secondary schools in academic year 2011-12 where their students were elected as tested (participants) and they were 52 teachers. With respect to Morgan's Table and given that size of population (1408) at 95% level of confidence, the needed sample size includes 302 participants and by considering 15% as loss coefficient, quantity of sample size was selected randomly with 353 participants.

**Data Collection Tools**

In order to gather data in this study, scale of Kolb's Learning Styles has been adopted to collect data information:

**I) Kolb's Learning Styles Refined Scale (KSLI-V3.1-2005):** Kolb's learning styles scale has been designed and executed by David Kolb (1985) based on Experimental Learning Theory (ELT) and since time of its publication five versions of this scale have been published (Kolb and Kolb; 2005; Kolb and Kolb, 2011). The refined scale (Version 3.1), which was published by Kolb and Kolb in 2005, includes 12 items where each item has four choices and test should score his/ her answers based on the rate of similarity with the continuum from 1 to 4 (4 denotes the maximum likelihood and 1 suggests the minimum similarity). Three results are extracted by execution of this scale: 1) *Learning modes* (9): including four techniques: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE) where 12 items are derived by adding four elements. These techniques indicate thinking style and model of persons when they are exposed to information so no one may be preferred to another. 2) *Learning preferences and techniques* (10): They are obtained by subtracting Abstract Conceptualization from Concrete Experience (AC-CE) and also Active Experimentation from Reflective Observation (AE-RO) and indicate individuals' attitude and preference in learning. 3) *Learning Styles* (11): In this case, two scores are characterized by transferring

onto Cartesian coordinates (based on positive or negative sign of obtained figure) and by comparison with normal data, four learning techniques are determined including convergent, divergent, accommodator and assimilator methods.

This scale has been adopted for many studies and the appropriate values have been reported for its validity and reliability (Jamison 2010; Kolb & Kolb 2005). For instance, Kolb and Kolb (2005) as builders of this scale have introduced appropriate validity and reliability for the given test. Similarly, Joy and Kolb have reported 0.79-0.94 as Cronbach Alpha Coefficient values for these four learning elements and they have suggested values of Construct Validity and correlation at favorable level with parallel form. In third version of Leaning Styles Inventory in 1990, Kolb has acquired the reliability value for this questionnaire based on Cronbach Alpha coefficient and test re-test for age group 18-24 in 705 participant sample group after eight weeks. Also in Iran, Hosseini Lorgani (1998) has administered Kolb's Learning Styles Inventory on academic students and computed reliability of this inventory based on Cronbach alpha coefficient. Results of this study are given in Table 6-3. By conducting a study on learning styles among nursing students, Through analysis on confirmation and exploratory factor rather than determination Cronbach alpha coefficient higher value than 0.75 for each of four learning styles .

**RESULTS**

In first section, to conduct analysis of study data, dependent t- value inferential statistical technique was adopted because of application of IT technique for all students and conducting measurement at two stages of pre-test (before application of IT) and post-test (after using IT) as well as lack of control group in this survey. Due to encoding learning styles (nominal variable) at next phase, Cramer's V- Willcoxon non- parametric statistical method has been adopted in order to compare four learning styles among girls and boys in public and non- public schools. At the same time, all presuppositions were explored in using statistical tests and then the given hypotheses have been tested.

***Hypothesis I***: Application of ICT in lesson of natural science textbook affects on scores derived from concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE) among students of smart secondary schools in Qom Province. Results of dependent t-test are given in Table-1 for comparison between scores of tastes at pre-test phase with post-test stage.

With respect to Table-1T as it seen, variable CE is significant at level 0.05 (p (Sig.) = 0.00) in this table and in other words IT technique could modify mean scores of concrete experience (CE) for students in post-test stage. In reflective observation (RO) variable, this coefficient is not significant at level 0.05 ((p (Sig.) = 0.47). Therefore, the applied IT could not alter mean scores in variable of reflective observation (RO) at post- test phase. In testing of hypothesis, AC variable is also significant at level 0.05 (p (Sig.) = 0.05); that is the applied IT technique might change mean scores of abstract conceptualization (AC) at post test step while AE variable is not significant at level 0.05 (p (Sig.) = 0.582). Therefore, Null Hypothesis is not rejected; namely, the adopted IT method could not modify mean scores of active experimentation (AE) variable at post- test stage.

***Hypothesis II***: There is some difference between four learning styles (convergent, divergent, assimilator, and accommodator) for lesson of natural sciences and gender, type of schools and regions in at pre-test with post- test steps.

As it observed in table 2, hypothesis of this study is not approved. In other words, there is no significant difference among boys and girls in terms of four learning styles at pre- test stage. Results came from Cramer's V for review the existing differences in learning styles among boys and girls at post- test phase also show that the hypothesis of this study is not verified. Namely, there is no significant difference between boys and girls in terms of four learning styles at post- test step. There is significant difference among of public and non- public schools in terms of four learning styles at pre- test stage. In surveying of difference in learning styles among students from public and non- public schools this hypothesis of study is also confirmed at post- test step. In other words, there is significant difference between public and non-public schools in terms of four learning styles at pre-test phase. The results of Cramer's V Test showed in surveying difference in four learning styles among students from five urban regions in Qom Province that there is no difference between these regions in terms of the given learning styles. Namely, no significant difference is observed between schools from five regions in terms of convergent, divergent, accommodator and assimilator learning styles. In this regard, findings indicated that convergent learning style is the highest frequency among these regions and then divergent, accommodator and assimilator learning styles have most frequently used in these regions respectively.

**Table 1,** Results of dependent t- test for comparison between scores of concrete experience (CE) at pre- test and post-test stages

| Parameter Variables | Stages | Mean | Standard Deviation | d.f | T | Sig. |
|---|---|---|---|---|---|---|
| **CE** | **Pre-test** | 26.42 | 2.30 | -5.944 | -0.499 | 0.000 |
| | **Post-test** | 30.52 | 2.44 | | | |
| **RO** | **Pre-test** | 31.85 | 1.66 | 14 | 0.856 | 0.407 |
| | **Post-test** | 31.11 | 3.02 | | | |
| **AC** | **Pre-test** | 33.58 | 2.58 | 14 | -0.561 | 0.05 |
| | **Post-test** | 32.62 | 2.65 | | | |
| **AE** | **Pre-test** | 31.55 | 2.99 | 14 | 0.564 | 0.582 |
| | **Post-test** | 4.33 | 4.33 | | | |
| **Gender** | **Frequency** | Mean | Standard Deviation | T | Degree of Freedom | Significance level |
| **Male** | **25** | 17.42 | 2.42 | 0.132 | 48 | 0.89 |
| **Female** | **25** | 17.32 | 2.56 | | | |

**Table 2.** Results of Cramer's V- Willcoxon non- parametric Test at pre-test

| | Cramer's V | Sig. |
|---|---|---|
| **Gender * in learning styles (pre-test)** | 0.247 | 0.822 |
| **Gender * in learning styles (post-test)** | 0.321 | 0.486 |
| **Type of schools * in learning styles (pre-test)** | 0.0628 | 0.01 |
| **Type of schools * in learning styles (post-test)** | 1.208 | 0.03 |
| **Urban regions * in learning styles** | 3.68 | 0.23 |

**DISCUSSION**

In first part of hypotheses, findings showed that as contrast, application of ICT at pre-test than in post-test stage might affect on rate of scores in variables concrete experience (CE) and abstract conceptualization (AC); however, it has not affected scores derived from variables of reflective observation (RO) and active experimentation (AE). IT leads memory- based learning traditional concept toward creative and dynamic learning (Jariani, 2001). In this sense, Kolb's Learning Style, which is known as Experimental Learning Theory (ELT), also emphasizes on this subject. Learning forms by change in cognitions and beliefs among individuals so that in this model, learning is defined through experience, knowledge, and composition and conveying of mental experience to intellectual achievements and concepts. Also in this study, it was characterized that by modifying training techniques from traditional ones into educational technology, students changed their learning styles toward concrete experience (CE) and mental and abstract conceptualization (AC). In other words, instead of learning based on reflective observation (RO) and listening and or playing passive role in traditional method, they tried to deal with abstract conceptualization and more contemplative and internalized learning in educational technology method; as a result in this course, their slogan is to transfer less knowledge but instead improve more technique of conceptualization and production of knowledge. Therefore, adopting of educational technology plans for students may lead learning from passive and external nature into learning by means of concrete experience, internalization, and abstraction and this finding corresponds to Kolb's cognitive theories in which he argues that thoughts are not fixed in learning and they vary constantly and continually in different experiences and individuals deal with learning in four- step cycle including concrete experience (CE), reflective observation (RO), active experimentation, and abstract conceptualization (AC) (Kolb & Kolb; 2005). In other words, in comparison with traditional methods, adoption of educational technology plans have mainly contributed to individuals to deal with information processing according to concrete experience and abstract conceptualization. This matter signifies that school teachers can be converted into facilitators for learning process and act as stimulant toward development of learning by internalization and abstract ways and through improving students' information literacy instead of only conveying materials and contents and being the only actor in classroom.

Other findings also showed that using ICT might affect on four learning styles (convergent, divergent, accommodator, and assimilator). Namely, adoption of educational technology for students might generally modify four learning styles between students in such a way that after application of educational technology,

compared to pre-test stage; that is lack of using this technology, general learning style has been altered. So these findings are complied with results of studies done by Haddad (2007). Studies about learning styles began in 1950s and early 1960s. These styles built a bridge between cognitive studies (some processes like conception, learning, and thinking etc) and research on personality. Unlike individuals' learning skills, learning styles are referred to interests and preferences of individuals and they are called as parameters to understand learning technique and method among individuals.

Thus, nowadays ICT has entered into all human's life aspects and it affected sciences and techniques, thought and culture, and in one word human's life style in such a way that no aspect of individuals' social life is exception to this rule. Coincided with the world, teaching and learning have not been also excluded from such developments and performance of teacher and student, time and place of learning occurrence and nature of learning experiences have been transformed. Message of modern technologies is clear in all fields; computer and internet make people to work in another way, to communicate alternatively, to learn in another form and as one word to live in other style. As it was also indicated in this study, application of technology could change learning styles and mental processing among students in learning and acquisition of new information and experiences.

It is obvious that ICT may play a positive role in teaching and learning only when students and teachers to be familiar with how to use its parameters. All studies suggest that lack of knowledge about way of application and capabilities of ICT programs in training- learning process among students and teachers is one of the foremost barriers against its application in training process. So this signifies that simultaneously with application of ICT programs, it is also required training of school teachers and officials consistently in this field.

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