# INTERNATIONAL JOURNAL OF INSTRUCTIONAL TECHNOLOGY AND DISTANCE LEARNING

**November 2011**
**Volume 8 Number 11**

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**ISSN 1550-6908**

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International Journal of
Instructional Technology & Distance Learning

**Vol. 8. No. 11.**

**ISSN 1550-6908**

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**Editorial**

# Technological Revolution in Education – Part 3

**Donald G. Perrin**

Much of the early research (in Instructional technology) comes from the field of psychology. Starting with the audiovisual movement in the early 1900s, there were studies of the effectiveness of printed materials, simple models, and visual aids to facilitate instruction (Dale, 1954). A systematic combination of methods was also conceived:

> Great economies are possible by printed aids, and personal comment and question should be saved to do only what it can do. A human being should not be wasted doing what forty sheets of paper or two phonographs can do. Just because personal teaching is precious and can do what books and apparatus can not, it should be saved for its peculiar work. The best teacher uses books and appliances as well as his own insight, sympathy, and magnetism. (Thorndike, 1912)

As visual and audio technologies were developed, they were adopted as "visual" aids. The first half of the twentieth century gave us the gramophone, lantern slides, filmstrips, 16mm sound motion pictures, and radio. There was extensive research during World War II to determine how to best use these technologies (Hoban and Van Ormer, 1950). After World War II, audio-visual was augmented by the tape recorder, videotape recorder, broadcast television, and closed-circuit television (Chu and Schramm, 1961). There were many significant researech studies in communications and human sciences (Berelson and Steiner, 1964), (Gagne, 1965).

Through the mid-fifties, the technologies and related research were focused on group instruction (Schramm, 1960) with particular emphasis on television. With the advent of technologies for individualized learning such as language lab, teaching machines and programmed learning (Finn and Perrin, 1962), research was focused on learning processes and learner characteristics. Progress was accelerated by federal funding stimulated by the launching of Sputnik.

Much of the initial research compared the presentation technology with a control group and this pattern has continued till now. However, the release of SPSS statistical programs in 1968 facilitated multivariate research to extract significant data from a complex of interacting variables. In the 1980s SPSS for PCs made his option widely available. The majority of research seeks statistically significant differences, starting usually with a null hypothesis. However, Russell (2001) studied instances of "no significant difference" and concluded that these were equivalent options and offered viable alternatives for teaching and learning (Russell, 2001).

Much of the ongoing research is funded by government, military, industry, educational organizations, and foundations. Doctoral dissertations are a resource for many new ideas.

In the early 1960s when Hoban and Finn determined that technology was more than "men and machines", they opened the concept of instructional systems with complex interacting variables. When combined with research on psychology, sociology, neurology, genetics, biosciences, pharmacology, cybernetics, computers, artificial intelligence, and related disciplines, it provides a universe of research opportunities for improvement of teaching and learning.

In today's world, the survival of many organizations depends on continuing high quality research. Global competition has raised standards and hastened the demise of industries and business that could not *keep up*. We are starting to see this same phenomenon among educational institutions.

## References

Berelson, Bernard and Steiner, Gary A. (1964*) Human Behavior: An Inventory of Findings*. Harcourt Brace.

Chu, Godwin C. and Shramm, Wilbur (1967). *Learning from Television: What the Research Says*. ERIC

Dale, Edgar (1954) *Audio-Visual Methods in Teaching.* Dryden Press.

Finn, James D. and Perrin, Donald G. (1962) *Teaching Machines and Programed Learning, 1962: A Survey of the Industry.* U.S. Government Printing Office, OE-34019

Gagne, Robert M. (1965) *The Conditions of Learning*. Holt, Rinehart and Winston.

Hoban, Charles F. and van Ormer, Edward B. (1950) *Instructional Film Research 1918-1950*. Port Washington, NY: Office of Naval Research.

Russell, Thomas (2001) *The No Significant Difference Phenomenon: A Comparative Research Annotated Bibliography on Technology for Distance Education*, IDECC, 5th edition).

Schramm, Wilbur (Ed. 1966). *Mass Communications.* 2nd Edition. University of Illinois Press.

Smith, Carl U. and Smith, Margaret Foltz (1966). *Cybernetic Principles of Learning*. Holt, Rinehart and Winston Inc.

Thorndike, Edward L. (1912) *Education.* McMillan.

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**Editor's Note**: Total immersion in an activity stimulates enjoyment and learning. It is part of a series of interactions that can be studied separately and jointly. That is what this research is about. The results provide fundamental information to design of learning experiences that are absorbing and effective.

# An investigation of Flow Experience in Virtual Learning Teams

**Xiaojing Liu, Curt Bonk, Simon McIntyre, Richard Magjuka**
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## Abstract

Teamwork has become an increasingly important part of online learning environments. The widespread use of virtual teams in online courses has not been companied by adequate research to address those issues that affected the learning and productivity in virtual teams. The purpose of this study is to explore the relationship between the nature of computer-mediated communication technology and virtual team learning and creativity from a flow theory perspective. A survey was conducted to the students of several online programs. The findings of this study suggested that flow experience is associated with perceived characteristics of the computer software as well as with team-related creativity and learning outcomes.

**Keywords**: Flow, Computer-mediated interaction, Virtual team, Teamwork, Online learning, Creativity, creativity, technology, online participation, asynchronous

## Introduction

Teamwork has become an increasingly important part of online learning environments. A study conducted in an online MBA program in a big Midwestern university reported that 80% of the online courses in the program used virtual teams (Lee, Bonk, Magjuka, Su, & Liu, 2005). Many studies point out that teamwork activities provide a pedagogically-rich context to assist students in building meaningful knowledge and help foster a sense of community in online courses (Carabajal, LaPointe, & Gunawardena, 2003; Lee at al, 2005; Palloff & Pratt, 2005). However, concerns were also raised regarding the process loss (e.g. reductions in productivity) of virtual teams such as "pseudo collaboration" and "free riders." For example, studies found that in group work that encouraged collaboration in online courses, online students tended to divide their tasks, complete them individually, and then combine independent parts into a final product (Hathorn & Ingram, 2002; Kitchen & McDougall, 1999). The widespread use of virtual teams in online courses has not been companied by adequate research to address those issues that affected the learning and productivity in virtual teams.

One distinguishable arena of research on virtual teamwork, different from those of typical classroom teamwork, is the use of technological tools in virtual teamwork. The success of a virtual team depends on the balanced integration of technologies and team activities. Effective use of computer-mediated communication (CMC) technology tools such as asynchronous forums, email, and text-base chat that support synchronous or asynchronous communications is critically important for the success of virtual learning teams. In effect, CMC technology provides potential advantages over more traditional communication media (e.g., phone, fax, voice mail) in terms of storage, processing, and transmission capabilities (Culnan & Markus, 1987). Such tools can facilitate idea generation among group members and overall creative performance and innovation (Dewett, 2003). As the world becomes increasingly competitive, creativity and innovation are in higher demand in corporate and other work settings. The decisions about which tools are selected and which features those tools possess eventually impact the virtual team's creative processes and learning performances.

Few research efforts to date have attempted to understand how CMC technologies successfully assist teamwork in virtual environments and resulting creative expressions. Consequently, there is a need to investigate the distinctive capabilities of this medium such as the relationship between the nature of CMC technology and outcomes of virtual learning teams (Trevino & Webster, 1992). The purpose of this study is to explore the relationship between the nature of asynchronous communication technology and virtual team learning and creativity from a flow theory perspective.

## Literature

### *Flow theory*

*The original concept of Flow* is described as the "holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi, 1975, p. 36). Csikszentmihalyi (1990), who first developed the term flow, describes that people experience flow when they become so intensely involved in an activity that nothing else seems to matter and the experience itself is so enjoyable that people will do it even at great cost for the sheer sake of doing it. Following Csikszenthmihalyi (1990), a laundry list of definitions of the concept was proposed. However, it seems they commonly share some elements such as absorption ("the total immersion in an activity"), enjoyment, and intrinsic motivation (Bakker, 2003).

Flow theory suggests that involvement in a flow state is self-motivating because it is pleasurable and encourages repetition (Miller, 1973; Ghani, 1991). For an activity to lead to a flow state, a person must be motivated intrinsically and do the activity for the satisfaction of the activity itself. The person experiencing flowing typically has clear goals, feels in control, loses his self-consciousness, and experiences a distortion of time (Csikszentmihalyi, 1990). The theory and concepts of flow give rise to the interests of researchers from a variety of disciplines who have studied a diverse set of activities ranging from rock climbing and ocean cruising to mediation and ordinary work (Ghani, 1991). Increasingly more attentions have been given to studying the behavior of individual learning and technology impact and use from the perspective of flow (Ghani, 1991).

In this article, the concept of flow represents the users' "perception of the interaction with the medium as playful and exploratory" (Trevino & Webster, 1992, p540). It is used as a multi-dimensional construct, which represents the extent to which: (1) Control: the user perceives a sense of control over the computer interaction; (2) Attention focus: the user perceives that his or her attention is focused on the interaction; (3) Curiosity: the user's curiosity is aroused during the interaction; and (4) Intrinsic interest: the user finds the interaction intrinsically interesting (Trevino & Webster, 1992, p. 542).

### *Technology*

Ease of use, defined as "the degree to which a person believes that using a particular system would be free of effort," represents one of the important perceived characteristics of CMC technologies (Davis, 1989, p. 320). Csikszentmihalyi (1975) argued the feasibility of the activity for an individual encourages flow. Ease to use systems are likely to facilitate the feasibility of the task. Past research indicates that ease of use of technical systems allows users to focus on the task at hand rather than on difficulties in operating the technical systems (Elam & Mead, 1990; Hillman, Willis, Gunawardena, 1994; Trevitt, 1995). Studies also found ease of use is associated with the perceived enjoyment of interacting with computer systems (Davis, 1989) and the flow experience during computer interactions (Webster, 1989). A person who perceives more ease of use of the artifact is more likely to experience flow (Finneran & Zhang, 2003).

Empirical work has also shown that perceived ease of use influences flow in employee's daily work (Trevino & Webster, 1992). In addition, several studies have found that the perceived ease

of use of a system is linked to the user's attitude towards using the system (Davis, Bagozzi, & Warshaw, 1989; Bajaj & Nidumolu, 1998). However, no study has been conducted on the effect of ease of use in virtual learning teams. In an e-learning context, a learner's perception of an easy to use learner interface is important as it represents a linkage between person and technology that serves as the person–technology interaction (Choi, Kim, & Kim, 2006). We propose that in virtual learning teams where technology is the central hub of communication, the ease of use of a computer medium will facilitate flow as team members can concentrate on their work process rather than worrying about the system. In addition, we argue that a visually pleasant technology also facilitates flow experience as it is more likely to gain users' attention on interacting with the systems than visually unappealing ones. Thus, we have the following hypothesis:

Hypothesis 1a: An easy to use technology interface is positively related to flow experience in virtual teamwork

Hypothesis 1b: A visually pleasing technology interface is positively related to flow experience in virtual teamwork

Feedback from peers and mentors help monitor and facilitate the success of virtual teams. Finneran and Zhang (2003) proposed the link between adequate feedback on the task and flow experience. Anderson (1979) found in his study that immediacy-producing behaviors by teachers were significant predictors of instructional effectiveness. In another study, Baker (2003) found that instructor immediacy increases student enjoyment, and is associated with positive perceptions of learning. In a virtual team, the use of technology allows students to interact with the instructors (both internal and external) and peers for direct and timely feedback in virtual teams. However, technology tools vary in their ways of facilitating feedback both in quality and quantity. The technologies that facilitate immediacy of feedback are likely to enhance students' enjoyment and concentration for teamwork. Therefore, in our third hypothesis, we propose that the perceived capabilities of media facilitating feedback will be positively correlated with perceived flow in teamwork.

Hypothesis 1c: The immediacy of media facilitating feedback is positively related to flow experience in virtual teamwork

## Teamwork creativity

With the increased emphasis on the importance of creativity and innovation in society and organizations, an understanding of flow, becomes important for researchers in a variety of disciplines due to the close relation between these concepts and creativity (Amabile, 1988; Ghani, 1991; Koestler, 1984; Levy, 1978; Lieberman, 1977). For example, the flow experience was found to be linked with exploratory behavior (Ghani, 1995; Ghani & Deshpande, 1994; Webster, Trevino, & Ryan, 1993). Researchers have suggested that people need intrinsic motivations, control and freedom to be creative so that they can play with ideas and explore best solutions from a wide range of possibilities and materials (e.g., Amabile, 1983; Crutchfield, 1962; Csikszentmihalyi, 1990; Gruber, 1981; Lepper, Green, & Nisbett, 1973).

Amabile (1988) describes creativity as the "production of novel and useful ideas" and notes that "only the intrinsically motivated person, who is motivated by the interest, challenge and enjoyment of being in a maze …, will explore, and take the risk of running into a dead end here and there "(p. 144). Lieberman (1977) describes the intense involvement and enjoyment, which are both key characteristics of the flow experience, as a prerequisite to generating new and unique solutions to problems.

Creativity does not surface in the isolation of one mind but in the process of interaction with other people (Csikszentmihalyi, 1996). An increased level of interaction fosters the cross-fertilization of ideas which is expected to lead to more and better ideas (Leenders, van Engelen, & Kratzer, 2003). In a virtually distributed team, interactions would be difficult to occur without the

assistance of CMC technology tools. Elam and Mead's (1990) study provide evidence that in the problem solving processes of computer-supported collaborative teams, the key characteristics of flow such as becoming deeply engrossed in an activity, overall enjoyment, and control, could result in enhanced creative problem solutions. Although much of work previously focused on the relationship between information technology and creativity in organizational settings, few studies have investigated the relationship between flow in computer-mediated communication and virtual learning team activity. Listed below are two hypotheses related to flow experiences and creativity in virtual team work situations.

Hypothesis 2a: Flow is positively related to creativity of individuals in problem solving in virtual team work.

Hypothesis 2b: Flow is positively related to brainstorming productivity in virtual team work.

## Teamwork learning

Flow theory suggests that the challenge of an activity relative to the skills which an individual brings to the activity is the key determinant of the experience an individual derives from the activity (Ghani, 1995). Flow is likely to occur when there is a match between the skills of the participant and the challenge of the activity. An individual may continuously learn new skills and take on increasing challenges (Csikszentmihalyi & Larson, 1984) to remain in flow. Flow implies involvement and enjoyment and is usually accompanied by exploratory behaviors. Such experiences result in the kind of self-exploratory discovery that has been described as the best way to learn by modern learning theories (Ghani, 1995; Lepper & Malone, 1987).

The fun and playfulness in flow experiences is likely to engage participants in the process of the task rather than the end results (Nakamura, 1988). Students increase time on task in order to remain in the flow. According to flow theory, this positive subjective experience also becomes an important motivation for performing an activity (Csikszentmihalyi, 1975). If an activity "feels good," it is intrinsically motivating, and people are more likely to engage in the activity for its own sake (Csikszentmihalyi, 1975). Employees using CMC technologies that facilitate flow are more absorbed and interested in their interactions with the medium than those not using CMC. Therefore, they are expected to use the medium more. Thus, flow is likely to be associated with increased quantities of communication.

During flow interactions, people exercise and develop skills through exploratory behaviors. As purposeful and intrinsically valued exploration occurs, learning should result (Miller, 1973). Such learning should lead to a higher quality and quantity of outputs or products from the interactions, as noted in the following two hypotheses. Therefore, we propose that flow will be associated with positive changes in communication-related team work outcomes, such as learning outcomes and increased participation.

Hypothesis 3a: Flow is positively related to perceived learning in virtual team work

Hypothesis 3b: Flow is positively related to perceived team member participation in virtual team work

## Methodology

### *Measures*

A 19-item survey was developed to measure students' perceptions of flow experiences in virtual teamwork mediated through asynchronous communication forums. The variables relevant to this study include demographic variables (gender, work experience, age, and online courses taken), flow, and teamwork outcome related variables. Except for demographic variables, all items related to flow and teamwork outcomes were scored using a 5-point Likert scale, with 1 indicating strongly disagree and 5 indicating strongly agree.

#### *Flow*

Flow was measured by eight items which were adapted from Webster, Trevino, and Ryan's (1993) 12 item scale that was used to measure CMC technology interactions. The items measured

four sub-dimensions of flow: control, attention focus, curiosity, and intrinsic interest. Each sub-dimension was measured via two items. Sample items include: (1) control (i.e., This medium allowed me to control the interaction I had with my computer.); (2) attention focus (i.e., When using this medium, I was unaware of what is going on around me.); (3) curiosity (i.e., Using this medium aroused my imagination.); (4) intrinsic interest (i.e., This medium was fun for me to use.). The construct validity of this instrument has been demonstrated in several studies (Csikszentmihalyi, 1975; Malone, 1981; Webster et al., 1993). Cronbach's alpha for the eight items of flow was 0.748, which is consistent with alphas of other studies.

*Perceive teamwork outcomes*

The perceived impacts of using asynchronous discussion forums on work outcomes were measured in several areas:

- **Teamwork creativity**. Three items were used to measure perceived creativity of an individual in team problem solving when using an asynchronous discussion forum for team communications. The items were adapted from the study of Zhou and Geogre (2005). Cronbach's alpha for creativity variable was 0.79. Sample items include: "When using this medium for communication, I can often suggest new ways to improve the quality of work." And "When using this medium for communication, I can often come up with creative solutions to problems."
- **Idea generation**. Two items measured the degree of asynchronous communication media for facilitating idea brainstorming in virtual teamwork. Cronbach's alpha for this variable was 0.83. An example of the item is "This medium helped me brainstorm many ideas in virtual teamwork."
- **Team learning**. The perceived learning in virtual teamwork was measured by two items. Cronbach's alpha for team learning was 0.71. Sample items include**:** When using this medium for team work, "I often had a good learning experience. And "When using this medium for team work, I often felt shared knowledge created among teammates."
- **Team participation**. One item was used to measure perceived teamwork participation of group members (e.g. "When using this medium for team work, the group members seemed to participate actively.")
- **Immediacy of feedback**. Feedback in teamwork was measured by three items to assess the perceived capability of the medium for facilitating feedback in teamwork. Cronbach's alpha for the three items was 0.76. Sample items include: "This medium facilitates immediate peer feedback." And "This medium facilitates immediate instructor feedback."

***Computer skills***

Computer skills were measured via a single item that asked respondents to describe their skill level of using asynchronous communication forums in teamwork. (e.g. "How skilled are you in using the following medium for team communications?").

***Ease of use***

Ease of use was measured via a single item. The respondents were asked to respond to the following item: "Overall, I found this media easy to use in virtual team work."

***Frequency of use***

Was measured by one single item: "How often did you use this medium in one week?"

***Visual design of media***

Participants were asked about their satisfaction with visual design in facilitating teamwork.

## Participants

The surveys were administrated through email lists in several online programs (two graduate programs in a large Midwestern university and one undergraduate program in an Australian university). The participants were requested to respond to the survey questions regarding their experiences in using asynchronous discussion forums in their group-based problem solving activities in their online courses. It was estimated that approximately 600 students in total have access to these Listservs. There were a total of 108 valid responses collected from the students. Sixteen percent of the participants were in their twenties; 55% their thirties: and 21% in their forties. Fifty-five percent of the participants were female. The majority of learners (60.2%) had previously taken 1 or 2 courses in the program; 19.4% had 3-5 courses; and 18.5% had 6-10 courses. Few learners (7.4%) used asynchronous forums very often (more than 15 times a week); 29.6% participants used asynchronous forums more than 10 times a week; 32.4% use forums 6-9 times; 21.3% used forums 3-5 times; and 16.7% used them less than 2 times a week.

## Findings

Table 1 presents means and standard deviations for all variables used in the present study. Results indicated that most variable means were above the midpoint of the response scale and the standard deviation between 0.61 and 1.18 for each of the variables.

Table 1 also presents results from the correlation analysis. As indicated in the table, ease of use was positively correlated with flow ($r = .45$, $p < .01$). Frequency of medium use was positively correlated with flow ($r = .33$, $p < .01$). Visual design of medium was highly correlated with flow ($r = .60$, $p < .01$), and perceived degree of feedback immediacy was positively correlated with flow ($r = .47$, $p < .01$). Thus, H1a, H1b, and H1c were all supported by the data. In addition, flow was highly correlated with perceived learning ($r = .62$, $p < .01$) and idea generations ($r = .67$, $p < .01$). Thus H2a and H2b were supported. Flow had a positive relationship with perceived creativity in virtual team problem solving performance ($r = .50$, $p < .01$) and perceptions of active participation of members ($r = .33$, $p < .01$). H3a and H3b were supported.

**Table 1**
**Correlation analysis**

| | | M | Std. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Frequency of medium use | 3.18 | 1.18 | 1 | | | | | | | | |
| 2. | Skill | 4.2 | .90 | .39(**) | 1 | | | | | | | |
| 3. | Ease of use | 3.87 | 1.03 | .30(**) | .25(**) | 1 | | | | | | |
| 4. | Immediacy of Feedback | 3.36 | .96 | .10 | -.04 | .10 | 1 | | | | | |
| 5. | Visual Design | 3.55 | .96 | .23(*) | .03 | .42(**) | .38(**) | 1 | | | | |
| 6. | Creative performance | 3.86 | .68 | .21(*) | .16 | .18 | .48(**) | .49(**) | 1 | | | |
| 7. | Learning | 3.91 | .81 | .19 | .02 | .38(**) | .42(**) | .52(**) | .61(**) | 1 | | |
| 8. | Participation | 3.78 | 1.02 | .20(*) | -.02 | .30(**) | .34(**) | .29(**) | .35(**) | .65(**) | 1 | |
| 9. | Idea Generation | 3.75 | .88 | .12 | -.01 | .33(**) | .51(**) | .60(**) | .56(**) | .79(**) | .53(**) | 1 |
| 10. | Flow | 3.3 | .61 | .33(**) | .16 | .45(**) | .47(**) | .60(**) | .50(**) | .62(**) | .33(**) | .67(**) |

*** p< 0.001 level (2-tailed). ** p< 0.01 level (2-tailed). * p<0.05 level (2-tailed).

**Table 2**
**Hierarchical regression analysis**

| | ***Team Creativity*** | | ***Idea Generation*** | | ***Teamwork Learning*** | | ***Feedback*** | | ***Online Participation*** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ***B*** | **Δ *R²*** | ***B*** | **Δ *R²*** | ***B*** | **Δ *R²*** | ***B*** | **Δ *R²*** | ***B*** | **Δ *R²*** |
| Online course | -0.344 | .042 | .042 | .066 | -0.022 | .076 | -.101 | .055 | -.01 | .010 |
| Gender | 0.021 | | .107 | | .184* | | .046 | | .004 | |
| Work experience | 0.308 | | .023 | | 0.028 | | -.018 | | -.026 | |
| Age | -0.05 | | .075 | | 0.094 | | .061 | | .083 | |
| Frequency of use | 0.033 | .054* | -.100 | .019 | -.003 | .041* | -.014 | .014 | .128* | .041* |
| Skill | 0.078 | .008 | -.093 | .001 | -0.11 | .002 | -.083 | .004 | -.159 | .013 |
| Ease of use | -0.079 | .013 | .076 | .101** | 0.173 | .126*** | -.0111 | .008 | .191** | .068** |
| Flow | .527*** | .178*** | .690*** | .305*** | .538*** | .185*** | .537 | .185*** | .223 | .032 |
| Total $R^2$ | .295*** | | .493*** | | .430*** | | .265*** | | .163* | |
| Adjusted $R^2$ | .237*** | | .451*** | | .383*** | | .205*** | | .094* | |

*** p< 0.001 level ** p< 0.01 level * p<0.05 level

Hierarchical regression analyses were conducted to further explore the relationships between flow and the team outcome variables including: learning, creativity, active participation, feedback and idea generation (See Table 2 with Δ $R^2$ indicating $R$ square change by adding a block of variables into the regression model. $B$ represents standardized regression coefficients.). For the five equations demonstrated, four demographic variables which were used as control variables were entered as the first block of constructs, and then frequency of medium, skill, and ease of use were entered as the third, fourth, and fifth block separately. The flow variable was entered as the last block. The demographic variables did not return significant effect on the four team variables.

For team creative performance, at the second step where frequency of medium was entered, $R^2$ change ($\Delta R^2$) is significant ($\Delta R^2$=0.054). For the fourth step where the flow is entered, $R^2$ change ($\Delta R^2$) is significant with a value of 0.178, and the total $R^2$ = .295. This result suggests that both frequency of medium and flow were significant predictors of team creative performance. Flow variable uniquely contributed 17.8% of variance in team creative performance, a large effect size.

For idea generation, at the fourth step where ease of use was entered, $R^2$ change was significant ($\Delta R^2$=.101). For the fifth step where the flow was entered, $R^2$ change is 0.335. This indicated both ease of use and flow were positive predictors of idea generation. Flow explained 33.5% of variance in idea generation.

For immediacy of feedback, only flow was a significant predictor of immediacy of feedback. Flow contributed 18.5% of total variances in immediacy of feedback.

For team learning, the regression analysis indicated that frequency of use ($\Delta R^2$=.041), ease of use ($\Delta R^2$=.126), and flow ($\Delta R^2$=.185) were all significant positive predictors of team learning. Flow accounted for 18.5% of variance in team learning.

For team member participation, both ease of use (second step, $\Delta R^2$=0.41) and the frequency of use (fourth step, $\Delta R^2$=0.068) accounted for a significant amount of the variance of idea generation. However, flow did not show any significant unique contribution to online participation although it had shown positive relationship with online participation in correlation

analysis. This indicated that the unique contribution of flow in team participation is not significant after controlling demographic variables and other variables.

## Limitations

Several limitations of this study should be noted. First, the participants of this study were not selected using a strict random sampling procedure. The sample mainly came from a number of online programs associated with several specific disciplines (such as business, education and art and design). Caution should be taken when generalizing the findings to other disciplines or contexts such as workplace settings. Second, the results may be subjected to common method variance bias since only self-report methods were used in this study. To address this concern, a Harman one-factor test (Harman, 1967), as described by Schriesheim (1979), was used to test for common method bias. A principal component factor analysis with varimax rotation was performed. A 6-factor structure was produced. The most important factor was found to only account for 34.17% of total variance explained, far below the 50%, which causes concern for common method bias. Third, the study addressed the issues related to CMC interactions in virtual teams via an asynchronous communication medium. Whether the results will hold for a synchronous communication medium should be further investigated. Therefore, caution should be taken when generalizing the results to other media environments different from asynchronous communication forums.

## Discussion

The findings from this study warrant further discussions and investigations in several areas. Overall, flow has shown to be a more critical variable than gender, age, work experience, frequency of use, and ease of use in predicting positive team outcomes.

The results supported that flow is associated with perceived ease of use. This result indicates that the design feature of a CMC medium is associated with the flow experiences of team workers. When engaging in interactions with a more easy-to-use and visually pleasing medium, the members are more likely to have a higher level of involvement and fun with their team work experience. This result is consistent with Trevino and Webster (1992)'s findings that the ease of use of a medium influences flow of activities in CMC interactions. Pace's (2003) qualitative study concerning the flow experiences of Web users provides insights for this relationship. It was found that a poorly designed interface can disrupt a flow experience by demanding an excessive amount of attention. The participants of this study identified several design elements that interfere with the transparency of an interface, and consequently distracted a user's attention. These elements included: lengthy response times, disorganized content, inconsistent navigation cues, cluttered page layout, inappropriate use of color, stale links, ambiguous link labels, and pop-up advertisements.

As we expected, the capability of media facilitating immediacy in feedback in teamwork was found to be closely related to flow experience. The size of the shared variance (18%) between flow and feedback shows that immediacy of media facilitating feedback is a strong predictor of flow. This result is consistent with Finneran and Zhang's (2003) proposal of the link between adequate feedback on the task and flow experience. When technology media is designed to facilitate more immediate feedback, the students may become more concentrated and intrinsically motivated in their teamwork. While they become more involved, students would be more likely to respond promptly to the inquiries of team members.

The results also supported that flow is strongly associated with a variety of positive virtual team outcomes. First, flow contributed considerably to the variance of team creative problem solving performance and idea generation. This result is consistent with previous findings that flow is

accompanied by creative exploratory behaviors (Ghani, 1995). It also represents an addition to the existing flow theories because it suggests that the relationship between flow and creativity in traditional work or play settings also applies to the settings of virtual teamwork. Flow appeared to be a solid predictor of brainstorming. In this study, the perceived level of flow in CMC was positively associated with the brainstorming productivity of virtual teams. Electronic brainstorming is one area of research that has gained increasing attention in illuminating the role of IT in facilitating collaboration (Dewett, 2003). Studies suggested that electronic brainstorming can reduce production blocking (such as loss of ideas due to the fact that only one person can speak at a time) and reduces evaluation apprehension (the reluctance to share ideas because of the fear of negative evaluation participants) (Dewett, 2003). This study suggests that besides the widely recognized CMC characteristics such as storing and distributing information, facilitating a sense of flow or playfulness in computer interactions may facilitate idea generation productivity in a virtual learning team.

Second, flow has proven to be a strong predictor for perceived learning in teamwork. The findings of this study that flow is accompanied by positive learning outcomes in virtual teams are consistent with previous research (Ghani, 1995). A virtual team member's learning experience can be more enhanced if she can experience involvement, concentration, control, and intrinsic interest in CMC interactions.

Third, the results show that by controlling demographic variables, the influences of skill, and the ease of use, flow did not make unique contributions to the active online participation of team members. The perceived flow of an individual member was not associated with perceived participation of other team members. The lack of association is most likely due to the medium used in this study: asynchronous communication media. The nature of asynchronous communication environments, such as a lack of aural-visual cues and delayed response time, may undermine the potential contagious effect of flow in virtual team work as demonstrated in a study by Bakker (2003). Therefore an individual member's state of flow is unlikely to influence other members' participation through this medium.

The findings of this study confirm that flow is associated with positive team work outcomes in a virtual learning team and that facilitating flow experience in virtual team may bring positive changes in team effectiveness.

## Future research

As an exploratory study in examining the relationship between flow and virtual learning team effectiveness, the findings of this study open several new venues for future research. First, this study demonstrated positive relationships between perceived characteristics of CMC, flow and virtual learning team outcomes. While this correlation study does not identify causal relationships, future research may use controlled experiments to investigate the effect of flow in virtual team outcomes. A structural modeling approach to investigating various antecedents of flow may also reveal more information on direct or indirect effect of various factors that may affect flow experiences in virtual learning teams in CMC interactions.

Second, this study noted a significant relationship between electronic brainstorming and flow. Brainstorming is the initial stage of a creative process. In his study, Nemiro (2002) identified four stages of the creative process: idea generation, development, finalization/closure, and evaluation. It will be interesting to investigate the role of flow in each stage and the relative impact of flow in each stage.

Finally, this study examined the students' flow experiences in asynchronous communication media. Previous research (Webster, Trevino, & Ryan, 1993) found that the curiosity and intrinsic interest aspects of the flow experience appear to be highly dependent with computers. The

relationship between flow and virtual team outcomes may vary depending on different types of media. For instance, the relationship between flow and team outcomes in asynchronous communication media may not be as strong as in synchronous communication. The next step of this research will compare the impact of flow in different types of CMC communications.

## Implications for practitioners

The findings of the present study suggested that flow is a strong and positive predictor of virtual team outcomes. Therefore, explicit facilitation of flow experiences should be considered in virtual learning team design. Several strategies might be considered to facilitate flow experiences of virtual team workers, including:

1. Designing technology to be technically easy to use and visually pleasant from the perspectives of virtual team members. Interface usability is one area where Web or course designers can take steps to minimize the distractions faced by users, and thereby maximize the opportunity to experience flow (Pace, 2003). Ongoing improvement of the Web-based learning systems and maintenance might include an easy-to-use systems interface, stability in content delivery, easy to load and reliable solutions, and satisfactory download speed (Choi, Kim, & Kim, 2006).
2. Consider designing "playfulness" into virtual team learning activities. Special expectations can have powerful effects on users' interactions with computer technologies (Trevino & Webster, 2007). Research has shown that perceptions of flow may be influenced by labeling the interaction with the CMC technology as play rather than work. Using CMC technologies for non-work (versus work), tasks may influence perceptions of the flow experience. CMC technologies are frequently used for playful, non-work communications (Webster et al., 1993). For example, a playful coffee house can be set up for sharing interesting and fun experiences for teams. Designing a group debate with playful icons indicating different roles may add a sense of playfulness to the activity. Virtual members can also learn to use emotion icons provided by the system to express fun and humor in group communications. Therefore, using CMC technologies in this way may influence the curiosity and intrinsic interest dimensions of flow.
3. Achieving a balance between challenges of technology and skills of users. According to flow theory, the balance between challenges and skills of technology use is one of the antecedents for flow. Whenever new and more complex technology is adopted for virtual team work, appropriate training should be provided to reduce learning curve. Sometimes disabling complex functions that are not essential for virtual teamwork is another way to balance and challenge the skills of the virtual team learners.

## Conclusion

The findings of this study suggested that flow experience is associated with perceived characteristics of the computer software as well as with team-related creativity and learning outcomes. For example, electronic learning systems designed to provide more learner control, focus the learner's attention, and incite cognitive enjoyment may result in more system use, more creativity in problem solving, and more positive attitudes (Trevino, & Webster, 2007). In the end, it seems flow is a state for effective online group performance that should be a goal of online learning team activities, courses, and programs. Perhaps the time has come to virtually go with the flow.

## References


Anderson, J. F. (1979). Teacher immediacy as a predictor of teaching effectiveness. In Nimmo, D. (Ed.), 1979. *Communication Yearbook* (**Vol. 3),** Transaction Books, New Brunswick, NJ, pp. 543–559.

Amabile, T. M. (1983). *The social psychology of creativity*. Boulder, CO: Westview.

Amabile, T.M. (1988). A model of creativity and innovations in organizations. *Research in Organizational Behavior*, *10*, 123-167.

Bajaj, A., & Nidumolu, S.R., 1998. A feedback model to understand information system usage. *Information & Management*, *33*, 213–224.

Bakker, A.B. (2003). Flow among music teachers and their students: The crossover of peak experiences. *Journal of Vocational Behavior*, *66*, 26-44.

Baker, J. (2000). *The effects of instructor immediacy and student cohesiveness on affective and cognitive learning in the online classroom*. Unpublished doctoral dissertation, Regent University.

Baker, J. (2003). Instructor immediacy increases student enjoyment, perception of learning. Online Classroom, September 2003.

Carabajal, K., LaPointe, D., & Gunawardena, C. (2003). Group development in online learning communities. In M. Moore, & W. Anderson (Eds.), *Handbook of distance education* (pp. 217-234). Nahwash, NJ: Lawrence Erlbaum Associates.

Culnan, M. J., & Markus, L. 1987. Information technologies: Electronic media and intraorganizational communication. In F. M. Jablin, L. L. Putnam, K. H. Roberts, & L. W. Porter (Eds.),*Handbook of organizational communication* (420-444). Beverly Hills, CA: Sage.

Csikszentmihalyi, M. (1990). The domain of creativity. In M. A. Runco & R.S. Albert (Eds.), *Theories of creativity*, 190-212. Newbury Park, CA: Sage Publications.

Csikszentmihalyi, M. (1975). *Beyond boredom and anxiety*. San Francisco: Jossey-Bass.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: HarperCollins.

Csikszentmihalyi, M., & Larson, R. (1992). Validity and reliability of the experience sampling method. In M. de Vries (Ed.), *The experience of psychopathology*. New York: Cambridge University Press.

Choi, D.H., Kim, J., & Kim, S.H. (2006). ERP training with a web-based electronic learning system: The flow theory perspective. *International Journal of Human-Computer Studies*, *65*, 223-243.

Crutchfield, R. (1962). Conformity and creative thinking. In H. Gruber, G. Terrell, & R. Wertheimer (Eds.), *Contemporary approaches to creative thinking* (pp. 120–140). New York: Atheton.

Davis, F. D., Jr. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIT Quarterly*, *13*, 319-342.

Davis, L. (1989, April 1). Phone mail gets stamp of approval. *Datamation*, pp. 69-78

Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (1989). Use acceptance of computer technology: comparison of two theoretical models. *Management Science*, *35*(8), 982–1003.

Dewett, T (2008). Understanding the relationship between information technology and creativity in organizations. *Creativity Research Journal*, *15(*2), 167-182.

Elam, J.J., & Mead, M. (1990). Can software influence creativity? *Information Systems Research 1*, 1-22.

Fulford, C. P., & Zhang, S., 1993. Perception of interaction: the critical predictor in distance education. *The American Journal of Distance Education*, *7* (3), 8–21.

Finneran, C.M., & Zhang P. (2003). A person-artifact-task (PAT) model of flow antecedents in computer-mediated environments. *International Journal of Human-Computer Studies,* (59)4, 475-496.

Ghani, J. (1995). Flow in human computer interactions: Test of a model. In Carey, J. (Ed.), *Human factors in information systems: Emerging theoretical bases* (pp 291-311). New Jersey: Ablex Publishing Corp.

Gruber, H. (1988). The evolving systems approach to creative work. *Creativity Research Journal*, *1*, 27–59.

Hartman, A., & Sifonis, J. (2000). *Net ready: strategies for success in the e-conomy*. New York, NY: McGraw Hill.

Hathorn, L. G., & A. L. Ingram. (2002). Online collaboration: Making it work. *Educational Technolo*gy, 42(1), 33-40.

Hillman, D. C., Willis, D. J., Gunawardena, C. N. (1994). Learner-interface interaction in distance education: an extension of contemporary models and strategies for practitioners. The *American Journal of Distance Education*, *8*(2), 30–42.

Kitchen, D., & McDougall, D. (1999). Collaborative learning on the Internet. *Journal of Educational Technology Systems, 27*(3), 245-258.

Koestler, A. 91964). *The art of creation*. New York: Dell.

Lepper, M., Green, D., & Nisbett, R. (1973). Undermining children's intrinsic interest with extrinsic rewards: A test of the "overjustification" hypothesis. *Journal of Personality and Social Psychology*, *28*, 129–137.

Lepper, M. R., & Malone, T. W. (1987). Intrinsic motivation and instructional effectiveness in computer-based education. In R. E. Snow & M. J. Farr (Eds.), *Aptitude, learning, and instruction: III. Co-native and affective process analyses* (pp. 255-296). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Leenders, R. T., van Engelen, J., & Kratzer, J. (2003). Virtuality, communication, and new product team creativity: A social network perspective. *Journal of Engineering and Technology Management*, *20*: 69–92.

Levy, J. (1978). *Play behavior*. New York: Wiley.

Lieberman, J. N. (1977). *Playfulness*. New York: Academic Press.

Lee, S., Bonk, C. J., Magjuka, R. J., Su, B., & Liu, X. (2006). Understanding the dimensions of virtual teams. *International Journal of E-learning*, 5(4), 507-523.

Miller, S. (1973). Ends, means, and galumphing: Some leitmotifs of play. *American Anthropologist*, *75*, 87-98.

Malone, T. W. (1981). Toward a theory of intrinsically motivated instruction. *Cognitive Science*, *4*, 333-369.

Nakamura, D. (1975). Optimal experience and the use of talent. In Csikszentmihalyi & I.S. Csikszentmihalyi (Eds.), *Optimal experiences: Psychological studies of flow in consciousness*. Cambridge, MA: Cambridge University Press.

Palloff, R., & Pratt, K. (2003). *The virtual student: A profile and guide to working with online learners.* San Francisco, CA: Jessey-Bass, Inc.

Pace, S. (2003). A grounded theory of the flow experience of Web users. *International Journal of Human-computer Studies*, *60*, 327-363.

Runco & R. S. Albert (Eds.), *Theories of creativity* (pp. 190–212). Newbury Park, CA: Sage.

Schriesheim, CA. (1979). The similarity of individual directed and group directed leader behavior descriptions. *Academy of Management Journal*, 22(2), 345-355.

Trevitt, C. (1995). *Interactive multimedia in university teaching and learning: some pointers to help promote discussion of design criteria*. In: Proceedings of the Computers in University Biological Education Virtual Conference. CITI Liverpool, 30 January–10 February.

Webster, J., Trevino L. K., & Ryan, L. (1993). The dimensionality and correlates of flow in human computer interactions. *Computers in Human Behavior*, *9*(4), 411-426.

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**Editor's Note**: Learning English as a Foreign Language is the subject of much research. By gaining a greater understanding of the factors and mechanisms involved, it should be possible to train better teachers, design more effective lessons, and enable students to learn more efficiently.

# The Relationship among EFL Learners' Autonomy, Academic Performance, and Motivation

**Rahman Sahragard, Zahra Jokar, Seyyed Mohammad Ali Soozandehfar**

**Iran**

## Abstract

This study was an endeavor to investigate the relationships among learners' autonomy, motivation and GPA. To achieve the objectives of the present study two data gathering instruments were used. The Autonomy Questionnaire of Kashefian (2002) was used to measure the students' degree of autonomy and the Motivation Questionnaire developed by Lain (1987) was employed. In order to collect the necessary data, the instruments were given to 60 college students (female and male) majoring in English Translation and Literature at Shiraz Payamenoor University. Participants were conveniently sampled. The data obtained underwent certain statistical procedures to determine the relationship of autonomy, motivation and GPA. Analysis of the data revealed a significant positive relationship between motivation and GPA, as well as autonomy and GPA. But findings of the present study also showed that learners' autonomy did not significantly correlate with motivation. In addition, according to the regression analysis, autonomy scores are better predictors of GPA than motivation.

**Keywords:** autonomy, academic performance, motivation

## Introduction

Distance education began in Russia in 1850. The trend was then followed in Germany, Switzerland, and Sweden and later in other countries. The first such institution, "Open University", was established in U.K in 1969. Iran was among the first third world countries that developed this system during the seventies.

Distance education provides courses and learning materials to students studying at locations distant to the parent institution. Separation of both the teacher and the student is a distinguishing feature of distance education. This gap between the teacher and student puts a higher level of responsibility on the shoulders of students. Distance learners must be more responsible for the conduct of their learning. "The term *distance learner* itself invites an assumption that a learner of this type is expected to have gained, to some extent, learner autonomy" (Januin, 2007, p.16). Mukhamedyarova and Cotter (2005) defined learner autonomy as opportunities for civic action, critical thinking, and personal responsibility in learning. Distance or Open learning provides a wide access to education (Holmberg, 1999) and promotes learner autonomy (White, 2003). Learner's motivation is another factor that is very important in distance education and plays a key role in one's capacity to cope with challenges of distance learning experiences (White, 2003). Keller defines motivation as " the choices people make as to what experiences or goals they will approach or avoid and the degree of effort they will exert in that respect"(Keller 1991 cited in Crookes & Schmidt, 1991 p. 389).

A number of factors affect motivation of the students in distance education: "loneliness, isolation, competing commitments, absence of the structuring aspects of face-to-face classes, and difficulty in adjusting to a distance language learning context" (White, 2003, p.115). With a better understanding about learner's autonomy and motivation, teachers can implement effective ways

to train students to take more responsibility for their own learning and to cope with loneliness and isolation of the learner and the teacher in such systems (White, 2003). Successful academic performance may partly be the result of being autonomous and/or motivated to learn on one's own.

Learning English is an important issue in the educational system in Iran. Distance and mainstream educational systems can be facilitating or debilitating and have effects on EFL academic performance in some aspects. One of the facilitating factors, as mentioned above, is learner autonomy. A teacher-centered system may make many students alien to learning autonomy. Teachers in the traditional system take most of the responsibility and most of the students are passive and they are not responsible for the conduct of their learning. Such students encounter a lot of problems in distance education. They cannot be responsible for their own learning and they may lose motivation to pursue higher education on a distance-learning basis. These factors can affect their academic performance, especially when they are EFL learners. Therefore it is very important to consider the role of autonomy and motivation in students' academic success in distance education. In light of the issue raised above, this study endeavors to look at the relationship between autonomy together with motivation and academic EFL performance.

### *Objectives of the study and Research Questions*

The purpose of this study is to investigate the relationship of autonomy, academic performance and motivation of EFL learners. The study seeks to answer the following questions:

1. Is there a significant relationship between Autonomy and GPA?
2. Is there a significant relationship between Motivation and GPA?
3. Is there a significant relationship between Autonomy and Motivation?

## Literature Review

### *Empirical Studies*

#### Autonomy and Academic Achievement

Many researchers considered learner autonomy as an important factor in effective language learning (Holmberg, 1995; Jung, 2001; Kearsley, 2000; Keegan, 1996; Peters, 1998). Murphy (2005) studied distance learners of French, German, and Spanish via a pilot study done at the south region of UK Open University. Distance learners were given supplementary materials to develop critical reflection, metacognition, and autonomy. These students were active and sought interaction opportunities. This study revealed that language learners exercised a considerable degree of functional control in their learning. She also suggests that learners must be encouraged to enhance their capacities for reflection and self-direction; it is required to introduce them an explicit framework available to guide their progress and give them clear rationale, encouragement, support, along with the opportunity to practice within the course materials. All of the learners demonstrated some critical reflection ability but those who used the supplementary materials demonstrated this largely.

Chen and Willits (1998) investigated the effects of learner autonomy on learning outcomes. They found that learner autonomy included independence and interdependence but neither of them had significant effects on learning outcomes.

Vanijdee (2003) studied learner autonomy in a distance learning context in Thailand and the researcher found the skills of autonomous language learners. These skills were cognitive and metacognitive strategies. The researcher believed that it is necessary to teach many of these skills

and strategies. White (1995) found that distance learners used more metacognitive skills, particularly self-management, involved in learner autonomy, than face-to-face learners.

Anderson (1993) investigated the relationships among student individuality, uniqueness and successful completion of distance education courses versus successful completion of traditional classroom courses. He found that learning styles and self-directed learning readiness did not influence successful completion rates of distance contexts versus traditional context. Staton-Cross (1988) examined the relationships among learning style, learning performance, and learning autonomy of learners in traditional and non-traditional Associate Degree Nursing programs. The study found that the majority of the learners were autonomous but the learners in the traditional context were more autonomous than learners in the distance context. The study also revealed that students' classification (i.e. freshman or sophomore) did not influence the degree of learners' autonomy. Wegner, Holloway and Garton (1999) examined the effects of distance context on students' achievement. They also studied the impact of distance learning on students' attitudes. They found that there wasn't any negative effect on student achievement or students' attitudes. Chia-Jung (1999) investigated the effect of students' task value and self-efficacy on their achievement in a web-based course. Ruth (2001) found that online learning environment could provide a self-directed, dynamic and autonomous learning environment for distance language learners.

King et al. (2001) tried to determine the relationships among students enrollment in asynchronous learning, self-efficacy, self-regulatory learning, and performance outcome. Test analysis revealed that high and low SSSE and SRLs did not significantly affect students' performance outcome.

Savoie (1979) investigated the relationship between SELRS (self-directed learning readiness) and academic achievement. The study found that there was a positive relationship between self-directed learning readiness and achievement. Long (1991) studied students' self-directed learning readiness and educational achievement at two colleges in Georgia. It was found that there was a significant relationship between SDLRS and GPA. These studies suggest that student' self-directed learning readiness is related to students' achievement.

Januin (2007) explored readiness for Language Learning Autonomy among distance learners. This study was not enough comprehensive and it considered just three dimensions of autonomy. They were the learner's reliance on the teachers, the learner's perceptions towards the teachers' roles, and the learner's confidence in his or her own language learning ability. The researcher just explored the status of readiness of the learners for language learning autonomy. Trinh (2005) investigated the effect of curriculum innovation in language classes on learner autonomy. The study found that use of self-regulated skills and language learning autonomy would improve language learning.

Pruitt (2005) studied the relationships among on transactional distance and learner autonomy and student performance in distance learning courses. The study revealed that higher structure and dialog had a positive effect on quantitative course grades. The study showed that transactional distance would predict self-ratings of performance but not grades .The study also suggest that students who have a more distance learning experience tend to predict higher grades.

Dembo and Lynch (2004) considered the role of self-regulation on academic success. The study revealed that verbal ability and self-efficacy were significantly related to performance. Self-regulatory attributes were: intrinsic goal orientations, self-efficacy for learning and performance, time and study environment management, help seeking, and Internet self-efficacy. The study found that intrinsic goal orientation, and Internet self-efficacy, help seeking and time, and study environment management were not significant predictors of performance.

Kinzie, Sullivan and Berdel (1988) investigated the effect of the learner control and autonomy on their achievement in science computer-assisted instruction. The study showed that students under the learner control scored higher on the posttest than those under program control. It suggests that students given limited control over instruction achieve greater learning in the same amount of time than can students not given such control.

Jones (1998) investigated learner performance in self-instruction. Multivariate analysis showed clear separation between languages with and without self-instruction.

White (1999) investigated how the learners experienced a solo distance language-learning context. The Data collection cycle follows as shown in Table 1 below:

**Table 1**
**The data collection cycle**

| Phase | Timing | Means of Data Collection |
|---|---|---|
| Phase1 | Prior to course | Naturalistic interviews |
| Phase2 | Weeks1-2 | Open-ended questionnaire; ranking exercises; responses to statement of expectations |
| Phase3 | Weeks5-6 | Individual telephone interviews to clarify questionnaire responses |
| Phase4 | Weeks8-10 | Scenario exercise; yoked subject procedures |
| Phase5 | Weeks12 | Phase 2 questionnaire and ranking tasks; individual and telephone interview |

The study found that not only learner beliefs, but also certain learner characteristics contributed to how learners experience their first 12 weeks of self-instructed learning. The study suggests that individual difference between learners, tolerance of ambiguity, affect learners' reaction at the self-instruction interface.

Jing (2007) investigated the relationship between learner autonomy and Chinese students' English proficiency. The learner autonomy profile (LAP) was used to measure learner autonomy. To measure students' English proficiency the score of the college English test at level 4 (CET-4) was used. Data collection procedures were developed in 2 phases. First, multiple regression and correlation (MRC) was used to measure the degree of the relationship between the 4 factors of learner autonomy and English proficiency of the students. The results of the first phase showed that resourcefulness and gender (as a dummy variable) accounted for 12.5% of the variability in the proficiency score. To further explore the relationship between autonomy and English proficiency a semi structured phone interview was used in the second phase of the study. The results confirmed the role of resourcefulness and 2 other factors, persistence and initiative on English language proficiency. The researcher recommended a different MRC design with the LAP total score, motivation, and gender as independent variable, and the CET as the dependant variable.

Hurd (2006) studied the relationship between autonomy, motivation and success in the distance context. The study found that motivation, tutor feedback and personal responsibility play a crucial role in success. She also found that students' confidence and self-regulation could increase in the process of learning at a distance.

**Motivation and Autonomy**

Conttia (2007) investigated the influence of learner motivation on developing autonomous learning in an English-for-Specific-Purposes Course. Self-access language learning was an important part of this course. The study found that there were significant differences in regulation and self-efficacy between successful and less successful learners. It was also revealed that a number of social and contextual factors had an impact on the learners' success.

The Carnegie Project (Decharms, 1981) asserts that increasing motivation and enhancing learners' personal control on their own learning are related to each other. This Project claims that enhancing motivation will enhance learners' autonomy.

Wang and Palincsar (1989) noted that learners who are responsible for their own learning, their success enhances their own self-perception of competence and this enhances their motivation. Harter and Connell (1984) argue that success in learning enhances motivation and this in turn increases learners' autonomy. Cotterall (1999) asserts that motivation can be an antecedent of successful autonomous learning. Tremblay and Gardner (1995) self-efficacy and effort, both part of a motivational construct would influence learners' autonomous behavior, and therefore it comes before it. Tremblay and Gardner (1995) define self-efficacy as: "an individual's beliefs that he or she has the capacity to reach a certain level of performance and achievement" (p 507).

Shinge (2005) investigated the correlation among anxiety, motivation and autonomy. Participants of this study were 32 first-year French students. The instruments used were an in-house French test, the Foreign Language Classroom Anxiety Scale, the Attitude/Motivation Test Battery, and the Roles of Learners and Teachers. Students completed these four questionnaires during Weeks 5 and 13 of the semester. The study found that there was a correlation only between autonomy and motivation.

Bush (2006) studied the relationships among classroom community; the three basic needs of autonomy, competence, and relatedness; self-determined motivation; and academic emotions. Participants of the study were 859 undergraduate students who were mostly sophomore and junior level classes. Five instruments were used: Academic Emotions Questionnaire (AEQ), Academic Self-Regulation Questionnaire – (SRQ-A), Learning Climate Questionnaire (LCQ): Perceived Autonomy Support, Post-Secondary Classroom Community Scale and Basic Need Satisfaction in General: feelings I have. SEM was used for data analysis. The results showed that autonomy influenced students' self-determined motivation.

Spratt, Humphreys and Chan (2002) aimed to investigate the relationship between learner autonomy and motivation. The study tried to answer which comes first: autonomy or motivation. Participants were 508 students from nine different parent departments. An autonomy questionnaire was used and an item on motivation was included in the questionnaire. It was found that "motivation is a key factor that influences the extent to which learners are ready to learn autonomously, and that teachers might therefore endeavor to ensure motivation before they train students to become autonomous" (p. 245).

Tonks (2006) studied academic autonomy in Japanese children. An interview was done with 30 $5^{th}$ and $6^{th}$ grade Japanese students to validate the Self-Regulation Questionnaire-Academic Domain. The Japanese SRQ-A (J-SRQ-A) was developed. After doing exploratory factor analysis, it was found that J-SRQ-A provided the best model fit. The results showed that there was a positive correlation between autonomy and intrinsic motivation.

**Motivation and Academic Achievement**

Various studies have pointed out that motivation will affect language attainment and progress (Gardner and Lambert, 1959; Gardner, Lalonde, Moorcroft, and Evers, 1987; Mills, Pajares, and Herron, 2007). Shroff, Vogel and Coombes (2008) examined factors that support individual student intrinsic motivation in online discussions. They found that perceived competence, perceived challenge, feedback, perceived interest and perceived curiosity would strongly support intrinsic motivation.

White (1995a) studied the importance of affective factors on success in distance language learning. Her sample was novice Japanese and Spanish learners who studied in the distance

context. Learners pointed to nine conditions in their report. Motivation and confidence in one's capacity received the highest rankings. She concluded that affective factors such as motivation play a key role in students' success in the distance context.

Ramzanian (1998) studied the relationship among age, proficiency level, socio- economic status and different types of motivation (instrumental and integrative motivation). The study was among freshman and senior EFL majors in Shiraz University. The study found that the majority of the freshmen were instrumentally motivated. It was also found that students in high language proficiency group were more integretively motivated. The number of seniors who were instrumentally motivated was found to be equal with the number of senior students who were integretively motivated.

Ellis (1985) expresses the doubt that" we don't know whether it is motivation that produces successful learning or successful learning that enhances motivation"(p.119). Skehan (1989) investigated the relationship between success and motivation and the result showed that motivation produces successful learning rather than vice versa. A variety of factors affect students' motivation, among them how they perceive their own achievement (Masgoret & Gardner, 2003). Materials and what tasks they do in and out of the classroom also affect motivation. Other factors include students' autonomy; classroom methodology; students' relationship to the classroom group as well as to the society at large; their view of their teacher and power relationships with the educational institution; and their own anxiety, especially in classroom activities such as speaking and test taking.

Smith and Salam (2000) studied some online language schools and they found that online learning may influence successful uptake of cyber schools. They note that working in isolation in a cyber school, without any external deadlines or a framework to control learning progress, may affect learners' motivation. They also say that "Motivation is perhaps the hardest of all to deal with at a distance, but it is perhaps the most important of all to overcome if students and the cyber schools are to have successful outcomes"(p.17).

Svanes (1984) found a positive correlation between integrative motivation and language proficiency, and a negative correlation between instrumental motivation and language proficiency. This study dealt with the acquisition of Norwegian by foreign students at the Bergen University, Norway. European and United States students were found to be more integratively motivated that Middle Eastern, Africa, and Asian students, who were fund to be more instrumentally motivated than the Western students. In the total group, a weak positive relationship between integrative motivation and language proficiency and a negative relationship between instrumental and grades were found.

Roohani (2001) studied the motivational variables (integrative and instrumental) towards learning English as a foreign language among senior students majoring in English at Shiraz state and Shiraz Islamic Azad university. The results indicted that student at Shiraz state university and Shiraz Islamic Azad University. The results indicated that the students at Shiraz state university were more integretively oriented as compared with their peers at Azad University. Moreover, a positive relationship was found between integrative motivation and proficiency level.

Noels et al. (2000) studied students registered in English psychology class at French-bilingual University. The study found that language learners who had valued goals for language learning, particularly the goal of self-development and enjoyment in learning, tended to be more involved and successful in that learning experience. In other words, interesting and enjoyable learning is not enough and the importance of learning is important as well. He also found that the Deci, Ryan and Vallerand's self-determination hierarchy perfectly explained language learner motivation and it was less likely that self-determined learners feel anxious or to give up studying the language.

Noels, Clement, and Pelletier (1999) studied the connection between intrinsic motivation and whether learners had autonomy and achieved useful feedback. They found that intrinsic motivation was related to greater language success, greater motivation intensity, greater perceived competence, and less anxiety. They also found that learners who had little autonomy were less intrinsically motivated.

Noels (2001) also studied the relations between perception of teacher's communicative style and student motivation. He found that the more the teacher controlled students, the lower the students' intrinsic motivation. He also found that the integrative orientation was strongly correlated with intrinsic motivation and identical regulation.

Gardner and Lambert (1972) found that achievement in language learning and motivation had correlation. They noted that integratively oriented person would achieve greater L2 competence.

Gardner and Smythe (1981) used Attitude/Motivation Test Battery (AMTB) for studying the effects on French language achievement of learners' aptitude, attitudes, and motivation. They found that motivation and achievement had a greater correlation than learners' attitudes toward the learning situation. Hao et al. (2004) and Vandergrift (2005) also demonstrated a positive relationship between students' proficiency level and their motivation.

Neisi (2007) investigated the relationship between self-esteem, achievement motivation, foreign language class anxiety and EFL learners' academic performance. The study found that the relationship between self-esteem and EFL learners' academic performance was positive and significant. The relationship between achievement motivation and EFL learners' academic performance was also positive and significant. The relationship between foreign language class anxiety and EFL learners' academic performance was negative and significant. The study also found that the best predictor variables for EFL learners' academic performance were achievement motivation and foreign language class anxiety.

Kahoe and MC Farlan (1975) studied the relationship between intrinsic and extrinsic motivational orientation and the freshmen GPAs of high and low challenging courses. Learners' GPA highly correlated with their intrinsic motivation in high challenging courses and their GPA were positively related to extrinsic motivation.

Liu (2006) studied Chinese University students' attitudes and motivation to learning English and their relationship with their achievement in English. He found that students had a positive attitude toward learning English and highly motivated to study it. He also found that students' attitude and motivation positively correlated with their English proficiency.

Many studies mentioned above have been largely confined to study of the relationship among learners' autonomy, motivation and GPA among students in mainstream context. Many other studies have been limited to validation of construct of autonomy (Carr 1999; Ponton 1999; and Derrick, 2000). It is necessary to investigate a clear link between learner's autonomy, motivation and GPA among students in distance context which leaves a gap in the literature of distance learner's autonomy, motivation and GPA.

## Method

### *Participants*

The participants of the study consisted of 60 Payamenoor university Shiraz branch students majoring in English Language Translation and Literature. The subjects were selected through convenient sampling since random sampling was not much practical for this study. There were 40 female and 20 male participants; therefore the majority of them were female. All the students were young with the age range of 23-28. Descriptive statistics such as frequencies and percentages were used to summarize and describe the data regarding the participants of the study.

### *Instruments*

The necessary data about the participants' autonomy were collected via a questionnaire developed by Kashefian (2000). She took the items from two questionnaires by Cotterall (1995) and Cotterall (1999). This questionnaire includes 40 items which employs a 5-point Likert-scale format. The choices range from strongly agree to strongly disagree. The translated version of the questionnaire was employed (see Appendix A). The second questionnaire was Gardner's Attitude/Motivation Test Battery (AMTB) which was administered to measure learners' motivation. This questionnaire includes 20 items which employs a 5-point Likert Scale format (ranging from strongly agree (1) to strongly disagree (5), (see appendix A).

**Reliability of Questionnaires**

In a sample of male and female B.A. and M.A. students majoring in English Literature in the Department of Foreign Languages and Linguistics of Shiraz University, Kashefian (2000) reported an internal reliability coefficient of 0.76. Using Cronbach's alpha in this study, the reliability index of the Learner autonomy questionnaire appeared to be 0.83 which shows that this questionnaire has functioned well in terms of consistency.

Salimi (1990) and Fazel (2000) used the motivation questionnaire in their studies but they did not report the reliability of the questionnaire. The reliability of the motivation questionnaire for this study was established via Cronbach's alpha. The Cronbach's alpha for the whole questionnaire was found to be 0.66 which shows that the questionnaire is moderately reliable.

**Validity of questionnaires**

Cotterall (1995, 1999) performed factor analysis of responses to validate her instruments (autonomy questionnaire). In her 1995 study, twenty-six items were incorporated into a five-point Likert-type format. A forced choice format was given to the remaining eight items. Factor analysis of participants' responses to the questionnaire revealed the existence of six dimensions which were: 1) role of the teacher, 2) role of feedback, 3) learner independence, 4) learner confidence in her ability, 5) experience of language learning, and 6) approach to studying. In her 1999 study, the questionnaire had 90 items that were in Likert-type scale. After doing factor analysis, six factors were identified which were 1) role of the teacher, 2) role of feedback, 3) sense of self-efficacy, 4) important strategies, 5) dimensions of strategies-related behavior, and 6) the nature of language earning. Kashefian (2002) also used a questionnaire the items of which were taken from the two questionnaires by Cotterall (1995) and Cotterall (1999). A factor analysis revealed the existence of five underlying factors of learner autonomy: 1) learner independence, 2) dependence on the teacher, 3) learner confidence, 4) attitudes toward language learning, and 5) self-assessment.

In order to study the validity of the motivation questionnaire in this study a statistical factor analysis was run on the learner autonomy questionnaire. The results of factor analysis revealed that 10 components were extracted from the Autonomy questionnaire (see appendix B).

Salimi (1990) and Fazel (2000) did not report anything about the validity of the motivation questionnaire. The items of the questionnaire were developed and validated by Laine (1987) at the University of Jyvaskylain in Finland. His questionnaire included two major categories of items, each of which had some subcategories. The first category that includes items 1-20, tries to measure students' motivation. The second major category that attempts to measure students' attitudes cover items 21-36. Motivation includes five sub-categories. The first category relates to motivation and tries to measure the students' direction of motivation including 1 to 4. The second category that includes items 5 to8 attempts to measure the students' intensity of motivation. The third sub-category that covers items 9 to 12 attempts to measure the students' instrumental motivation. The fourth category which includes items13 to 16 deals with the students' integrative

motivation. The fifth sub-category, items 12 to 20, is concerned with the students' cognitive orientation.

The validity of the second questionnaire in this study was calculated through a statistical factor analysis. The results of factor analysis revealed that 5 components were extracted from the motivation questionnaire (see appendix B).

### *Data Collection Procedure*

The learner's autonomy and motivation questionnaires were administered to 60 B.A. students majoring in English Language Translation and Literature in Payamenoor Shiraz University. Prior to the administration of the instruments, the researcher was introduced to the subjects by the instructors. Students were provided with sufficient information about the purpose of the study. Besides, they were also assured on the confidentiality of the results and the researcher promised to let them know about the results. The participants were requested to answer the questionnaires during their regular class time and without time limit. All students agreed willingly to complete the questionnaires.

Having collected the prerequisite data, the procedure of which was explained above, permission was sought from the Department of Foreign Languages and Linguistics of Shiraz Payamenoor University to use the grade point averages (GPAs) of the participants under the study as the indicator of their academic achievement.

### *Data Analysis*

In order to achieve the goals of this study in seeking the relationship among variables in this specific context, the data gathered were analyzed by the following statistical methods using SPSS software. First, descriptive statistics were utilized. Then, reliability indexes of the motivation questionnaire and learner autonomy questionnaires were obtained using Cronbach alpha. Pearson Product Moment formula was also used in order to find the correlation among the variables under the study. Finally, Regression analysis was used in order to "measure the degree and direction of influence the independent variable has on the dependant variables" (Alreck and Settle, p.319).

## Results and Discussions

### *Results*

#### Descriptive Statistics

Descriptive statistics of the students' academic achievement (GPA), learner autonomy and motivation were obtained utilizing Statistical Package for Social Sciences (SPSS). The results are provided in this part. Table 2 shows the descriptive statistics for the academic achievement (GPA).

**Table 2**
**Descriptive Statistics for Academic Achievement (GPA)**

| | No. of Participants | Minimum | Maximum | Mean | Std. Deviation | Skewness |
|---|---|---|---|---|---|---|
| **GPA** | 60 | 12.34 | 18.37 | 14.83 | 1.29 | .174 |

The results show that GPA ranges from a minimum of 12.34 to a maximum of 18.37, with a mean of 14.83 and a standard deviation of 1.29. Based on the above table, there is a positive skewness (Skewness = .174) in the distribution of students' GPA which means that students have achieved weakly. In order to test the normality of the scores an analysis was run the results of which appear in Table 3.

**Table 3**
**Tests of Normality of GPA**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| **GPA** | .061 | 60 | .200* | .985 | 60 | .660 |

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Table 3 shows the normality of the distribution of scores. According to Pallant (2007), "a non-significant result (Sig. value of more than .05) indicates normality" (p. 62). In this case, the sig. value is .200, suggesting the normality of the distribution of scores. Figure 1 graphically displays this normality.

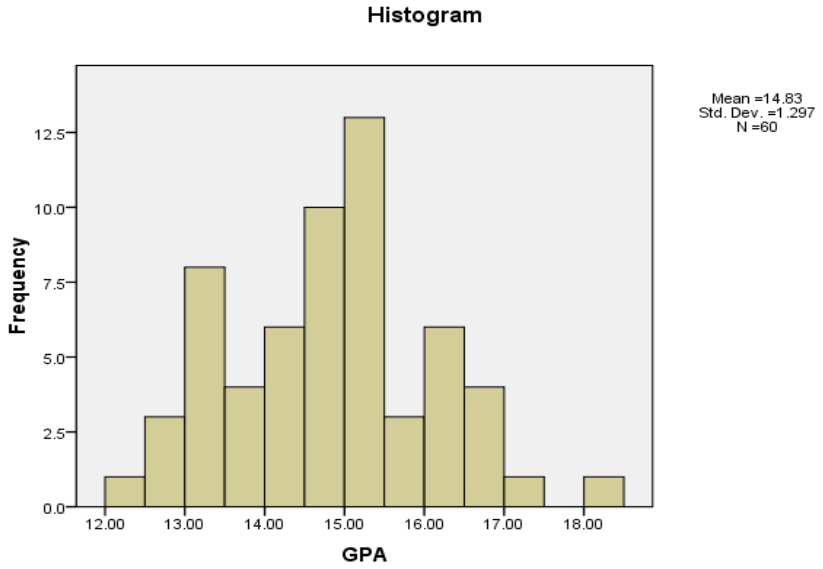


**Figure 1 Distributions of Scores on GPA**

Figure 2 illustrates that the participants' academic achievement scores (GPAs) are normally distributed as most of the scores are located in the center of the horizontal axis. Table 4 illustrates the Descriptive statistics for autonomy.

**Table 4**
**Descriptive statistics for Autonomy**

| | No. of Participants | Minimum | Maximum | Mean | Std. Deviation | Skewness |
|---|---|---|---|---|---|---|
| **Autonomy** | 60 | 70.00 | 164.00 | 125.17 | 21.94 | -.170 |

Table 4 indicates that the scores ranged from 70.00 to 164.00 (the scores are out of 200) which means that the variability of scores must be large; this is substantiated by the large standard deviation of 21.94. Meanwhile, an average score of 125.17 has been observed. This table shows

that though their autonomy seems to be normally distributed, a slight negative skewness can be observed in the curve (Skewness= -.170) and scores are located in the right side of the horizontal axis which mean that students are more autonomous and responsible for their own learning. In order to test normality of the scores an analysis was run the results of which appear in Table 5.

**Table 5**
**Tests of Normality of Autonomy**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Autonomy | .082 | 60 | .200* | .979 | 60 | .406 |

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Table 5 illustrates the normality of the distribution of autonomy scores. As the table shows, the sig. value is .200, suggesting the normality of the distribution of scores. Figure 2 graphically displays participants' autonomy scores.

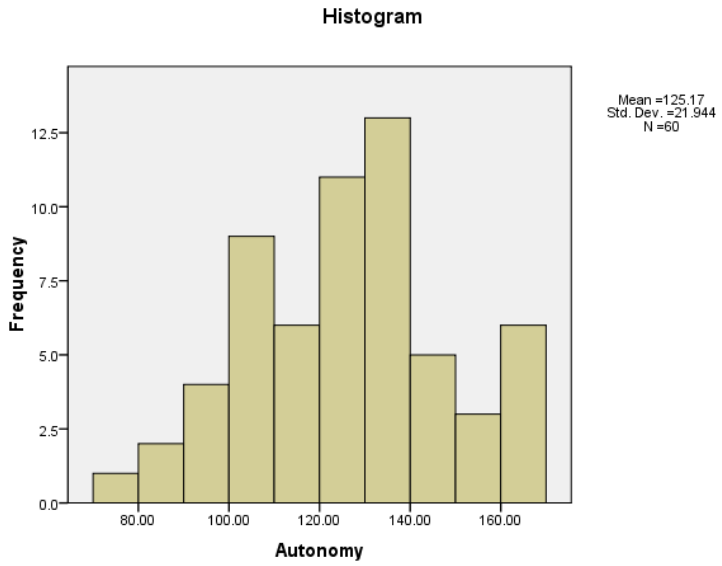


**Figure 2 Distributions of Scores on Autonomy**

Figure 2 shows how the students have performed on the Autonomy questionnaire. The scores seem to have a normal distribution. The last descriptive analysis deals with motivation which comes next. The descriptive statistics for motivation appears in Table 6.

**Table 6**
**Descriptive statistics for Motivation**

| | No. of Participants | Minimum | Maximum | Mean | Std. Deviation | Skewness |
|---|---|---|---|---|---|---|
| **Motivation** | 60 | 61.00 | 100.00 | 83.7667 | 9.00728 | -.391 |

According to Table 6, the scores range from 61.00 (which indicate the lowest score on Motivation) to 100.00 (that shows the highest Motivation score). The Standard deviation is 9.00.

The distribution of scores is negatively skewed (Skewness= -.391) and scores are located in the right side of the horizontal axis which shows that the students are highly motivated. Again a test of normality was run with the resulting output which is presented in Table 7.

**Table 7**
**Tests of Normality of Motivation**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Motivation | .088 | 60 | .200* | .979 | 60 | .378 |

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Table 7 illustrates the normality of the distribution of motivation scores. As the table demonstrates, the sig. value is .200 which suggests that the distribution of motivation scores is nearly normal. Figure 3 displays participants' Motivation.

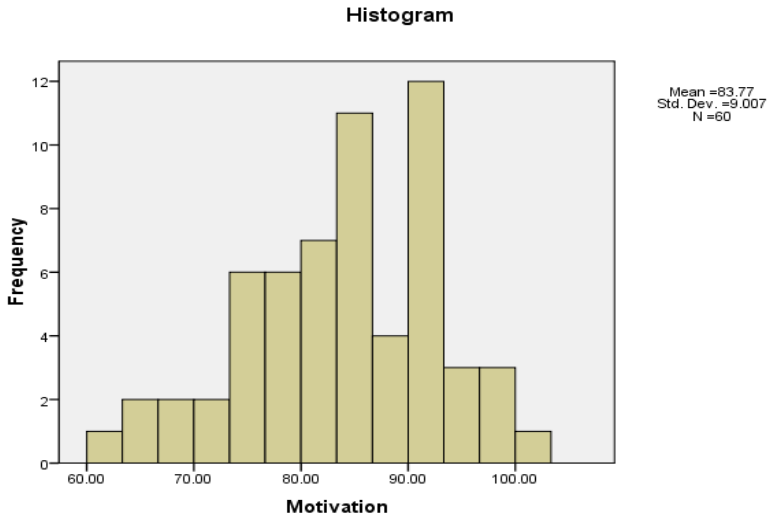


**Figure 3 Distributions of Scores on Motivation**

As it can be observed, there is rather a normal distribution of scores on motivation, and the majority of scores are located in the center of the graph and the curve is somehow bell shaped.

The next part of the analysis deals with inferential statistics.

**Results of the Correlation**

In order to find out the possible relationship between each pair of variables in this study and to find out the strength of any linear relationship, Pearson correlation analysis was run. Table 8 reports the results of the correlation analysis between GPA, motivation and autonomy.

**Table 8**
**Results of Pearson Correlation analysis among GPA, Autonomy and Motivation**

| | | GPA | Autonomy | Motivation |
|---|---|---|---|---|
| GPA | Pearson Correlation | 1 | .547** | .385** |
| | Sig. (2-tailed) | | .000 | .002 |
| | N | 60 | 60 | 60 |
| Autonomy | Pearson Correlation | .547** | 1 | .079 |
| | Sig. (2-tailed) | .000 | | .547 |
| | N | 60 | 60 | 60 |
| Motivation | Pearson Correlation | .385** | .079 | 1 |
| | Sig. (2-tailed) | .002 | .547 | |
| | N | 60 | 60 | 60 |

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

Table 8 reveals a significant positive relationship between the GPA and the Autonomy (r=.547, p<0.01), which indicates that EFL distance students who are more autonomous in English language teaching in Payamenoor University can achieve better GPAs in their studies. Figure 4 shows the scatter plot for autonomy and GPA.

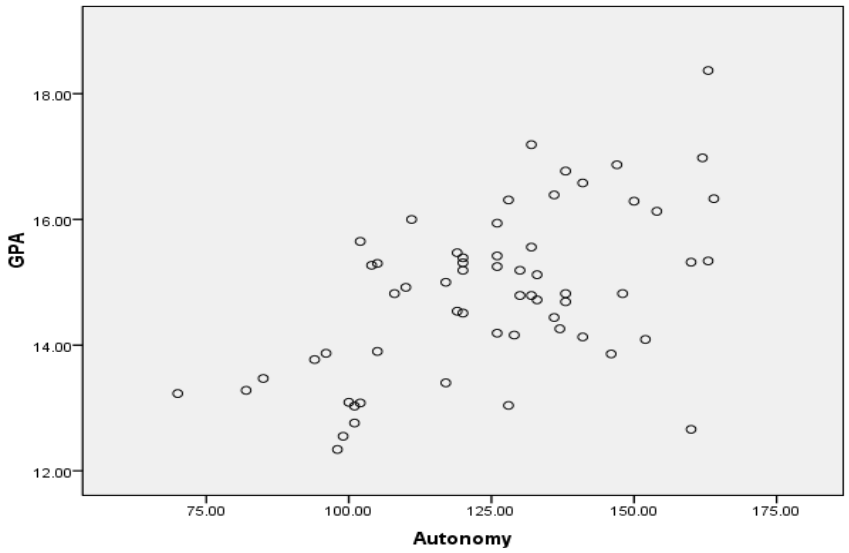


**Figure 4 Scatter plot of Autonomy and GPA Correlation**

From the scatter plot above and Table 4, there appears to be a strong, positive correlation between the two variables (autonomy and GPA) for the sample as a whole. Points are arranged in a slightly narrow cigar shape and suggest a moderate correlation. The scatter plot also shows that the relationship between autonomy and GPA is positive. By drawing a line through the points upward, high scores on autonomy are associated with high scores on GPA. In other words, the more students are autonomous, the higher they achieve during an academic term (r=.547, p<0.01).

The results also indicated that GPA and Motivation have a positive significant relationship ($r=.385$, $p<0.01$), which shows that students who are more motivated can have a better performance in their classes. Figure 5 shows the scatter plot for motivation and GPA.

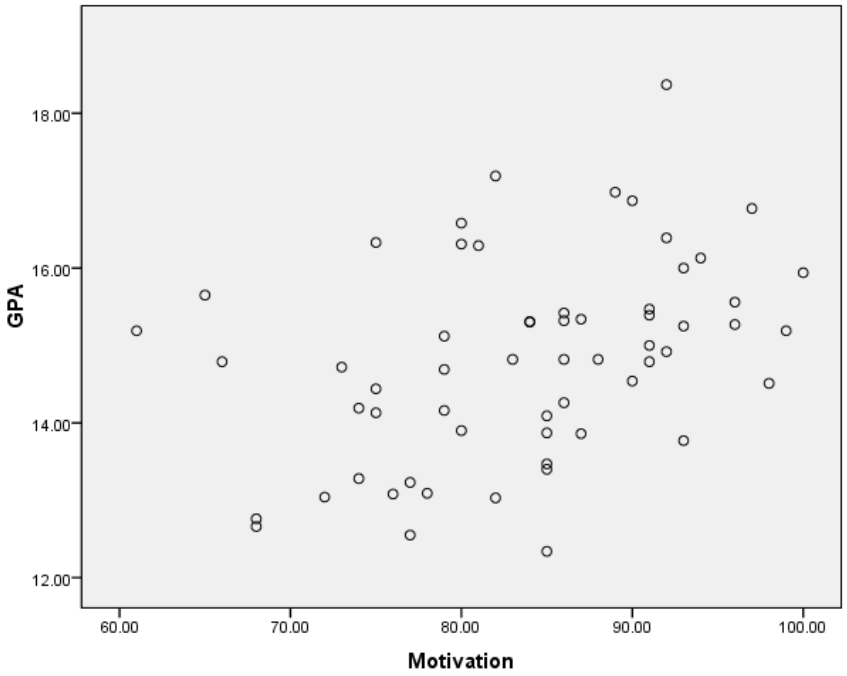


**Figure 5 Scatter plot of Motivation and GPA Correlation**

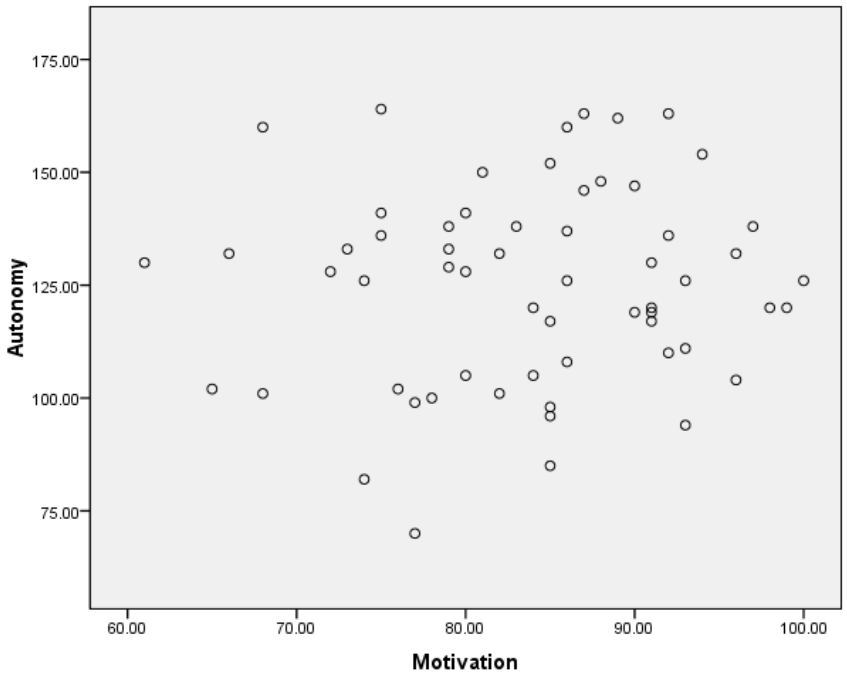


**Figure 6 Scatter plot of Motivation and Autonomy correlation**

As the scatter plot shows the relationship between motivation and GPA is positive. The direction of the relationship between motivation and GPA is upward and indicates that the more students are motivated, the more they get good grades or ranks. Of course the correlation is moderately low ($r=.385$, $p<0.01$).

Finally, the results indicates that autonomy and motivation have a positive relationship which is not significant ($r=.079$, $p<0.54$). Figure 6 shows the scatter plot for motivation and Autonomy.

Based on the above scatter plot, there is a small correlation between autonomy and motivation. The distribution of data points is not along a straight line through the main cluster of points and the points are spread almost all over the place. This suggests a very low correlation. The relationship between autonomy and motivation is directed upward that indicates a positive relationship.

### *Results of the Regression analysis*

As part of the design of the study, a linear regression analysis was run to predict the variance in a dependent variable from the variance in independent variables; that is, to see which variables predict academic achievement better. Because the correlation between autonomy and motivation was not significant, this procedure was used only for GPA (dependant variable) and autonomy and motivation (independent variables). According to Alreck & Settle (1994, p. 319) "regression analysis is an appropriate technique to measure the relationship between variables and assess their significance." The results of this analysis appear in Tables 9 and 10.

**Table 9**
**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .646[a] | .417 | .397 | 1.00715 |

a. Predictors: (Constant), Motivation, Autonomy

b. Dependent variable: GPA

Table 9 reveals that the value of R2 for Autonomy is .417 meaning that the Autonomy and GPA share 41% of the variance between themselves.

According to Table 10, Beta values indicate that one standard deviation unit change in the score for Autonomy will result in 0.52 units of change in GPA. However, one standard deviation unit change in the score for Motivation will result in 0.34 units of change in GPA. Thus, with respect to Table 10, Autonomy scores are better predictors of GPA than Motivation.

**Table 10**
**Coefficients**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 6.837 | 1.389 | | 4.920 | .000 |
| | Autonomy | .031 | .006 | .520 | 5.127 | .000 |
| | Motivation | .050 | .015 | .344 | 3.392 | .001 |

a. Dependent Variable: GPA

## Discussion

The results presented in Table 5 revealed that students' GPA scores and learner' autonomy have a significant relationship ($r=.547$, $p<0.01$). Cohen (1988) suggests that Pearson correlation coefficients (r) range from .10 to .29 shows that there is a small correlation between the two variables. The values between .30 and .49 indicate a medium correlation. Range of .50 to 1.0 refers to a large strength of correlation. One possible explanation for these findings is that according to Dickinson (1995, p.174)" learning success and enhanced motivation is conditional on learners taking responsibility for their own learning, being able to control their own learning". The finding of the study in relation to question1 is in line with the reports given by Grove, Wasserman and Grodner (2006) and Tross et al, (2000) who studied the relationship between GPA scores and autonomy. They found that there was a positive, significant relationship between autonomy and GPA. In addition, Lowe (2009) examined the relationship between the learner autonomy and academic performance as measured by GPA. The findings showed that there was a positive, significant relationship between Learner Autonomy as measured by the Learner Autonomy Profile Short Form (LAP-SF) and GPA. She also found that LAP-SF may be a diagnostic tool for improving academic performance. Liu (2007) also investigated the relationship between learner autonomy and Chinese university students' English proficiency. In the first phase (Quantitative study), the results revealed that resourcefulness (one component of LAP-SF) and gender accounted for 12.5% of the variability in the CET-4 score (to measure English language proficiency). In the second phase (Qualitative study), data confirmed the role of resourcefulness in successful English language learning and two other factors, persistence and initiative (components of LAP-SF) were identified as important factors. The finding of Liu's study is in line with results of this study which shows that there is a positive and significant relationship between autonomy and successful language learning.

Savoie (1979) and long (1991) studied the relationship between self-directed learning readiness scores (which is another aspect of autonomy) and course performance. They found that there is a positive relationship between self-directed learning readiness scores and achievement. Moreover, Long and Mooris (1996) investigated the self-directed learning readiness scores and academic achievement in a nontraditional higher education program. They found that self-directed learning is positively associated with the mastery of knowledge or skill. In addition, Candy(1991), Reio and Leitsch (2003) found that more autonomous learners are more tolerant of risk and ambiguity, reflective, self-starting, creative, and ultimately successful in various learning contexts. Furthermore, Knowles (1990) also found that higher levels of self-directed learning readiness make students more independent and responsible for their own learning. Also, Reio (2004) studied the effect of prior knowledge, self-directed learning readiness, and curiosity on classroom learning performance in a college classroom. He found that prior knowledge had no relation to any of the variables except ethnicity. Self-directed learning readiness was the most powerful predictor of learning performance. Finally he showed that self-directed learning readiness and curiosity exclusively predicted learning performance.

The results of the present study indicates a positive correlation existing between students' Motivation and their GPA and they have a significant positive relationship ($r=.385$, $p<0.02$). The language learning demotivation (LLM) by Gardner (1985) can give us an explanation: he considers motivation as an independent variable and achievement as a dependant variable and considers that" The higher an individual is motivated, the higher are his or her achievements". Another possible explanation for this finding is that students' attitude to the English language learning may affect their motivation and in the same way their proficiency (Oller, Hudson and Liu (1977).This is surely in line with Rubin (1975) who postulates at least three variables affecting effective language learning: aptitude, motivation, and opportunity. This study has experimentally shown this, at least, for motivation. Dornyei and Skehan (2003) take this a bit

further and claim that motivation affects humans thinking and behaving, sustaining an activity for a long time and working hard on that activity. The participants in this study could be considered rather motivated since academically they have achieved good standings in a program of study that does not offer much. One argument could be that they have made it in the face of the odds because of their own motivation. Mortimer (2000) concluded that for any distance education program to be successful, motivation has to be ingested into the design.

According to the findings of this study, a significant correlation was not found between student's autonomy and their motivation ($r=.547$, $p<0.01$). There is a positive correlation between autonomy and motivation but this relationship is not significant. In other words a small correlation between Autonomy and Motivation suggests a weak relationship between them. According to Pallant (2007)," with large sample, even quite small correlation coefficients can reach statistical significance."(p.122). So one possible explanation for this non significant correlation between autonomy and motivation could be due to the fact that the sample in this study was small. Another possible explanation for this finding is that there is a complex relationship between autonomy and motivation. Spratt, Humphreys and Chan (2002) argue that "The relationship between motivation and autonomy could also be dynamic and operate in different directions depending on the kind of motivation involved (p. 262)." This result might also be because the study was conducted in different academic levels and majors. According to (Ushioda, 1996, Green, 1999), motivation itself is dynamic and that it can change in type and intensity over the course of a learner's studies. So this difference in their academic level and their course of studies may affect the significance of the relationship between autonomy and motivation. In contrast to the finding of this study, there are some other studies in which learner's autonomy and motivation significantly correlate. For example, Wang and Palincsar (1989) found a positive relationship between being responsible for learning and motivation. They show that putting responsibility on the shoulders of learners and making them able to choose their goals independently will increase their motivation and they can achieve their goals better. In fact, Cotterall (1999) asserts that motivation can be an antecedent of successful autonomous learning. Another supporting study is that of Reeve (2002) who found that there was a relationship among students' autonomy, intrinsic motivation and achievement. In addition, Bell (2010) investigated the relationship among autonomy, supporting competence, and relatedness to participant intrinsic motivation. The study found that supporting competence, supporting autonomy and relatedness have a significant effect on participant intrinsic motivation. Bush (2006) also studied how competence, autonomy and relatedness will affect self-determined motivation. He found that autonomy influenced students' motivation. It was also found that autonomy was a stronger predictor of students' motivation regulation. In a similar study, Shinge (2005) also studied the relationship between anxiety and motivation as well as between motivation and autonomy. The results showed that there was a correlation only between motivation and autonomy. The study also found that autonomous students are also motivated, but motivated students are not always autonomous. Tonks (2006) tried to investigate the effect of student's autonomy on their motivation because some researchers (e.g., Markus and Kitayama, 1991) suggested that in Japan autonomy may not be related to students' motivation. The study found a positive correlation between autonomy and intrinsic motivation, however.

In informal discussions with the participants of the present study, they expressed some concerns that can provide justification for the results. The participants suggested some reasons why distance context affects their autonomy and motivation.

Most of the students complained that in most of their lessons the materials did not have enough allocated portion for the applied materials. As Holden and Usuki (1999) offered, the desirable lesson for autonomous learners should be practical and just theoretical knowledge is not enough for learners.

Almost all the students noted that in the distance context they did not generally choose the objectives, the materials, what they should learn, and the activities. They noted that they did not have any option for choosing materials and books. In contrast, Chan, Humphreys and Spratt (2002) listed learners' role in autonomous learning that they choose the materials, the objectives, what they should learn and the activities.

Most of the students also said that their opinions were not voiced. They couldn't voice their ideas about the materials, the objectives and the kinds of activities. As Holden and Usuki (1999) noted, in autonomous learning; the students should be regarded as active participants and their needs and interests should be in priority.

A majority of the students complained about the condition that had a negative effect on their learning such as lack of active presence of the instructors. They said that the instructors are not actively involved in the students' learning process. Nortcliffe (2005) also mentioned that teacher's role might not become superfluous when learners become autonomous.

Almost all the students noted that they also were not trained in using relevant strategies to become autonomous and to experience such an independent learning. They stated they experienced a bad situation in their learning process, they didn't know which strategies they could use to deal with such a problem. They noted that they needed some thinking and problem-solving strategies in the distance context. Nortcliffe (2005) and Crookall (1983) stated that learners should learn some knowledge, skills, and strategies to cope with some negative factors that impede their learning process.

They added that the instructors did not provide opportunities for them to become self-motivated and self-interested. When learners are not self-motivated, as Crookall and Ho (1995) stated, learner autonomy cannot be applied.

The learners also noted that they just focused on memorizing the materials and they just attended formal testing. They said that most of their tests were in multiple-choice format and they could not promote their process-oriented learning activities. They just paid attention to rote learning and their learning was not active. The main concern was to gain good grades or pass the exam rather than to implement for the sake of learning. This reality supports Holden and Usuki (1999) and MacDaniel (1994) that rote learning and attention merely to formal testing instead of monitoring for effective feedback can hinder the entire learner autonomy.

Some of the students declared that they did not have enough group work and discussion on the materials. They could not share their knowledge with their classmates. They attended their classes as indifferent and passive learners. However, Lewis (2004) and Holden and Usuki (1999) noted that group work activities are as a requirement for learner autonomy. There were not any opportunities for them to be actively involved in the learning process and they could not set their interests and goals. They could not express who they are and what they should learn. Kenny (1993), Ryan (1991) and Littlewood (1999) explained that to have autonomous learners, it is necessary for learners to express who they are, what they think and what they are interested in.

In spite of all these concerns and findings, the participants of the present study showed rather acceptable levels of motivation and autonomy. One good reason to justify the lack of relationship between motivation and autonomy can clearly be seen in the learners’ statements that they time and again stressed that they have no voice in the curriculum. They obviously have motivation to learn but what is lacking here is the autonomy which the institution should cherish in the individuals.

## Conclusions

The analysis of the data gathered in this study led to the following results:

First, the findings of this study showed students' GPA scores and their autonomy had a positive and significant correlation ($r=.547$, $p<0.01$). There was a large correlation between the two variables, suggesting a strong relationship between autonomy and GPA. Therefore, there is a positive and significant relationship between students' autonomy and their academic achievement. In other words, EFL distance students who are more autonomous in English language teaching in Payamenoor University can achieve higher GPA in their studies.

Second, the results also revealed that there was a significant and positive correlation between students' motivation and GPA ($r=.385$, $p<0.01$), suggesting a moderate relationship between two variables. This means that students who are more motivated can have a better performance in their classes.

Third, the findings revealed that there was a non significant and positive correlation between autonomy and motivation ($r=.079$, $p<0.01$). The strength of correlation between two variables was weak. The results indicate that the relationship between autonomy and motivation did not appear to be significant. In other words, it was found that there was not any significant relationship between autonomy and motivation. This non significant relationship between the two variables may be related to the small sample size and suggests a need for further research. According to Pallant (2007)," with large samples, even quite small correlation coefficients can reach statistical significant."(p.122). So the non significant correlation between autonomy and motivation could be due to the fact that the sample in this study was limited to only one city or one university and the sample size was quite small. This was partly because the sample was related to students of Payamenoor University (distance context) and such students was not required to attend their regular classes; therefore, the researcher had difficulty finding a large sample.

This study started with the expectation to observe high motivation and autonomy on the part of participants. This expectation was grounded in the fact that the participants had achieved quite reasonable grades in the course of their study. Despite all the expectations to the contrary, the participants' autonomy was hampered by the policies set forth and implemented by the particular university. The participants proved, however, that they were highly motivated to adjust to a distance language learning context and maintain their study. This is implicitly reflected in their course grades they have passed and explicitly in their scores revealed by this study's questionnaire. This finding is quite extraordinary due to the fact that they have achieved something with little or no support coming from the institution.

## Pedagogical implications

The findings of this study suggest support for several implications in the field of foreign language teaching and learning.

Regarding the factors which are of high importance in this study, teachers should pay more attention to learners' autonomy. Measuring learners' autonomy and motivation at the beginning of each semester in the distance context, teachers will make students more responsible for their own learning and students would be imbued with more motivation for learning.

Based on the principles of autonomy, syllabuses and the course books of the distance universities should be redesigned. They should be assessed on the basis of the criterion which encourages fostering learners' autonomy. The course books should be of a high quality, be self-contained and have self-instructional and over-explicit materials.

Lack of teacher and face to face interaction between student and teacher or lack of peer contact may affect students' affective factors such as autonomy, motivation and so on (white, 2003). So it is better to put into practice some in-service training on learner autonomy. For example it is useful to involve learners actively in posing problems, teach them how to take a risk in making efforts to change and how to plan and monitor their own learning process. Because of the concerns, doubts and misunderstandings, it is necessary to train teachers to clarify, advise, and motivate students.

## Limitations

The present study may suffer from the following limitations.

Because not all the students of Payamenoor University were available to answer the questions of the study and the sample was limited to only one city and one Payamenoor university, the conclusions can not be generalized to other populations and situations.

Though both questionnaires used in this study turned out to be considerably valid and reliable, a combination of methods such as observation and interview could yield more reliable results.

## References

Allan, M. (1997). Assisting autonomous performance. *Prospect, 12(3)*, 4-14.

Alreck, P., & Settle, R. (1994). *The survey research handbook*. New York: McGraw- Hill.

Anderson, M.R. (1993). *Success in distance education courses versus traditional classroom education courses*. Dissertation abstracts international, 54(12A), 4339.

Barrett-Lennard, S. (1997). Encouraging autonomy and preparing for IELTS: mutually exclusive goals? *Prospect, 12(3)*, 29-40.

Bell, G.N. (2010). *Self-determination theory and therapeutic recreation: The relevance of autonomy, competence, and relatedness to participant intrinsic motivation*. Unpublished doctoral thesis, University of Clemson.

Benson, P. (2001). *Teaching and researching autonomy in language learning*. Harlow: Pearson Education.

Best, J.W., & Kahn, J. V. (1989). *Research in education*. Englewood Cliffs: Prentice Hall.

Brown, H. D. (2001). *Teaching by principles: An interactive approach to language pedagogy*. (2nd edition). New York: Pearson Education.

Bush, A.M. (2006). *What comes between classroom community and academic emotions: Testing a self-determination model of motivation in the college classroom*. Unpublished doctoral thesis, The University of Texas at Austin.

Candlin, C., & Byrnes, F. (1995). *Designing for open language learning - Teaching roles and learning strategies in Gollin, S (Ed) Language in distance education. How far can we go?* Proceedings of the NCELTR Conference. Sydney: NCELTR.

Candy, P.C. (1991). *Self-direction for Lifelong Learning.* San Francisco: Jossey-Bass.

Carr, P.B. (1999). *The measurement of resourcefulness intentions I the adult autonomous learner*. Doctoral dissertation, The George Washington University.

Chan, V., Spratt, M., & Humphreys, G. (2002). Autonomous language learning: Hong Kong tertiary students' attitudes and behaviors. *Evaluation and Research in Education*, *16(1)*, 1-18.

Chen, Y., & Willits, F. (1998). A path analysis of the concepts in Moore's theory of transactional distance in a videoconferencing learning environment. *Journal of Distance Education, 13(2),* 1-21.

Clement, R. (1980). Ethnicity, Contact and Communicative Competence in a Second Language in H. Giles, W.p. Robinson & P.M. Smith (Eds.) *Language: Social psychological perspective*. Toronto: Pergamon Press.

Clement, R., Gardner, R.C., & Smythe, P.C. (1977). Motivational variables in second language acquisition: a study of Francophones learning English. *Canadian Journal of Behavioral Science*, 9*(2)*, 123-133.

Cohen, A. D. (1998). *Strategies in learning and using a second language*. Harlow, Essex: Longman.

Conttia, L.M.W. (2007). *The Influence of Learner Motivation on Developing Autonomous Learning in an English-for-Specific-Purposes Course*. Retrieved April 29th, 2008 from http://www.asian-efl-journal.com/thesis_lai_conttia.pdf

Cotterall, S. (1995). Readiness for autonomy: Investigating learner beliefs. *System*, *23(2)*, 195-206.

Cotterall, S. (1999). Key variables in language learning: what do learners believe about them? *System, 27*, 493-513.

Cotterall, S. (2000). Promoting learner autonomy through the curriculum: Principles for designing language courses. *ELT Journal*, *54 (2)*, 109-117.

Crookall, D. (1983). Learner training: a neglected strategy. *Modern English Teacher, 11(1), (2)*, 41-42, 31-33.

Crookes, G., & Schmidt, R. W. (1991). Motivation: Reopening the research agenda. *Language Learning*, *41(4)*, 469-512.

Dam, L., & Legenhausen, L. (1996). The acquisition of vocabulary in an autonomous learning environment - The first months of beginning English. In R. Pemberton, et al (Ed.), *Taking control: Autonomy in language learning* (265-280). Hong Kong: Hong Kong University Press.

Decharms, R. (1976). *Enhancing motivation: change in the classroom*. Academic Press, New York.

Deci, E. L. (1980). *The Psychology of self-determination*. Lexington, MA: D. C.Heath.

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19(2),* 109-134.

Deci, E. L., Vallerand, R. J., Pelletier, L. G. & Ryan, R. M. (1991). Motivation and Education: The self-determination perspective. *Educational Psychologist*, *26*, 325-346.

Deng, L. (2007). *Fostering learner autonomy through meta-cognitive strategy training in EFL writing*. Symposium session presented at 2nd HAAL Research Forum, Hong Kong.

Derrick, M.G. (2000). *The measurement of an adult's intention to exhibit persistence in autonomous learning*. Doctoral dissertation, The George Washington University.

Dickinson, L. (1987). *Self-instruction in language learning*. Cambridge University Press.

Dickinson, L. (1995). Autonomy and motivation: a literature review. *System 23(2)*, 165–74.

Dornyei, Z. (2003). Attitudes, orientations, and motivations in language learning: Advances in theory, research, and applications. *Language Learning, 53*, 3-32.

Dornyei, Z., & Csizer, K. (1998). Ten commandments for motivating language learners: results of an empirical study. *Language Teaching Research, 2(3)*, 203–29.

Dornyei, Z., & Skehan, P. (2003). Individual differences in second language learning. In C. J. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (589-630). Oxford: Blackwell.

Ellis, R. (1999). *The study of second language acquisition.* New York: McGraw Hill.

Farhady, H., Jafarpoor, A., & Birjandi, P. (1994). *Testing language skills: from theory to practice*. Tehran: SAMT Publications.

Garcia, T., & Pintrich, P.R. (1995). *Assessing Students' Motivation and Learning Strategies: the Motivated Strategies for Learning Questionnaire* (Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA) (ERIC Document Reproduction Service No. ED383 770).

Gardner, D. (2001). Making self-access centers more effective. In D.K. Kember, S. Candlin and L.Yan (eds.) *Further Case Studies of Improving Teaching and Learning from the Action Learning Project*, Hong Kong: Action Learning Project.

Gardner, R.C. (1979). Social psychological aspects of second language acquisition. In Giles, H., & St. Clair, R. (eds), *Language and social psychology*. Oxford: Basil Blackwell.

Gardner, R.C. (1982). Language attitudes and language learning. In E. Boudhard Ryan & H. Giles, *Attitudes towards language bariation* (pp. 132-147). Edward Arnold.

Gardner, R. C. (1985). *Social Psychology and Second Language Learning: The role of attitudes and motivation*. London: Edward Arnold Publishers Ltd.

Gardner, R. C., Lalonde, R. N., Moorcroft, R., & Evers, F. T. (1987). Second language attrition: The role of motivation and use. *Journal of Language and Social Psychology, 6(1)*, 29-47.

Gardner, R.C., & Lambert, W.E. (1959). Motivational variables in second language acquisition. *Canadian Journal of Psychology, 13*, 191-197.

Gardner, R. C., & Lambert, W. E. (Eds.) (1972). *Attitude and Motivation in Second Language Learning*. Rowley, Massachusetts: Newbury House Publishers.

Gardner, R.C., & MacIntyre, C. D. (1993). On the measurement of affective variables in second language learning. *Language Learning*, *4,* 157-194.

Gardner, R.C., & Smyth, P.C. (1981). On the development of the Attitude/Motivation Test Battery. *The Canadian modern language review,37*, 510-525.

Giles, H., & Byrner, J.L. (1982). An intergroup approach to second language acquisition. *Journal of Multicultural and Multilingual development, 3*, 17-40.

Green, C. (1999). Categorizing motivational desires in second language acquisition. *Language, Culture and Curriculum 12(3)*: 265–79.

Hall, O. & Beggs, E. (1998). Defining learner autonomy. In Renandya, W. & Jacobs, G.M. (Eds.), *Learners and language learning* (pp.26-39). Singapore: SEAMO Regional Language Centre.

Hao, M., & Hao, R. (2001). Research on the Relationship between English Achievement and Achievement Motivation as well as Anxiety State: A Case Study. *Foreign Language Teaching and Research*. *33(2)*: 111-115.

Harris, C. (1995). What do the learners think? A study of how it's over to you learners defines successful learning at a distance. In: Gollins, S. (Ed.), *Language in Distance Education: how far can we go?* Proceedings of the NCELTR Conference. NCELTR, Sydney.

Harter, S., & Connell, J. P. (1984). A model of children's achievement and related self-perceptions of competence, control, and motivational orientation, in Nicholls, J. G. *Advances in Motivation and Achievement*, *3*. London: JAI Press Inc.

Ho, J., & Crookall, D. (1995). Breaking with Chinese cultural traditions: learner autonomy in English language teaching. *System 23(2):*235–43.

Holden, B., & Usuki, U. (1991). Learner autonomy in language teaching: a preliminary investigation. *Bulletin of Hokurikh University*, *23*, 191-203.

Holec, H. (1981). *Autonomy and Foreign Language Learning*. Pergamon Press for the Council of Europe, Oxford.

Holmberg, B. (1995). *Theory and practice of distance education*. Roultledge.

Hurd, S. (2006). Towards a Better Understanding of the Dynamic role of the Distance Language Learner: Learner Perceptions of Personality, Motivation, Roles and Approaches. *Distance Education, 27(3),* 299-325.

Januin, J. (2007). *Exploring Readiness for Language Learning Autonomy among Distance Learners in Sabah, Malaysia*. Unpolished PhD thesis, Malaysia Sabah University, Malaysia.

Jones, F.R. (1998) 'Self-instruction and success: a learner profile study', *Applied Linguistics*, *19 (3)*, 378-406.

Jung, I. (2001). Building a theoretical framework of web-based instruction in the context of distance education. *British Journal of Educational Technology, 32(5)*, 525 – 534.

Kahoe, R.D., & MacFarland, R.E. (1975). Interaction of task challenge and intrinsic and extrinsic motivation in college achievement. *Journal of educational psychology*, *67*, 432-438.

Kashefian Naini, S. (2002). *An investigation into college EFL learners' beliefs demonstrating their predispositions towards learner autonomy.* Unpublished master's thesis. Shiraz University, Shiraz, Iran.

Kearsley, G. (1996). *Andragogy*. Washington DC: George Washington University. Available: http://gwis2.circ.gwu.edu:80/~Kearsley/Knowles.html.

Kearsley, G. (2000). *Online education: learning and teaching in cyberspace*. Belmont, CA: Wadsworth.

Keegan, D. (1990). *Foundations of distance education*. London and New York: Routledge.

Kenny, B. (1993). For More Autonomy. *System, 21(4),* 431-42.

King, F. B., Harner, M., & Brown, S. W. (2000). Self-regulatory behavior influences in distance learning. *International Journal of Instructional Media, 27*, 147-155

Kinzie, M. B., Sullivan, H. J., & Berdel, R. L. (1988). Learner control and achievement in science computer-assisted instruction. *Journal of Educational Psychology, 80(3),* 299-303.

Knowles, M. (1980). *Modern practice of adult, education: From pedagogy to andragogy*. SanFrancisco, CA: Jossey-Bass Publishers.

Knowles, M. (1990). *The adult learner: A neglected species* (4th Ed.). Houston, TX: Gulf Publishing.

Knowles, M. S. (1995). *Self Directed Learning: A Guide for learners and Teachers*. Chicago: Association Press.

Lain, J.E. (1987). *Affective factors in foreign language learning and teaching cross- language studies*. Jyvaskyla: Jyvaskyla University. Department of English.

Lavin, D. (1965), *The Prediction of Academic Performance: A Theoretical Analysis and Review of Research*. Russell Sage Foundation, New York.

Lewis, J. (2004). The independent learning contact system motivating students enrolled in college reading courses. *ProQuest Educational Journals*, *41(3)*, 188-194.

Lin, Chia-Jung. (1999). *The effects of self-efficacy and task values on students' commitment and achievement in web-based instruction for Taiwan higher education*. Dissertation Abstracts International Section A: Humanities & Social Sciences. Vol 60(6-A) 1905.

Little, D. (1991). *Learner Autonomy 1: Definitions, Issues and Problems*. Dublin: Authentik.

Little, D. (1999). Developing learner autonomy in the foreign language classroom: A social-interactive view of learning and three fundamental pedagogical principles. *Revista Canaria de Estudios Ingleses, 38*, 77-88.

Little, D. (2001). Learner autonomy and the challenge of tandem language learning via the Internet in Chambers, A., & Davies, G. (Eds). *ICT and language learning: a European perspective.* Lisse: Swets and Zeitlinger.

Littlewood, W. (1999). Defining and developing autonomy in East Asian contexts. *Applied Linguistics*, *20*, 71–94.

Liu, Jing. (2007). *Learner autonomy and Chinese university students' English proficiency: A quantitative and qualitative study*. Unpublished PhD Thesis. Regent University.

Long, H.B. (1991). Self-directed learning: Consensus and conflict. In H.B. Long & Associates (Eds.). *Self-directed learning: Consensus & conflict* (pp. 1-9). Norman, OK: Oklahoma Research Center for Continuing Professional and Higher Education of the University of Oklahoma.

Long, H.B., & Morris, S. (1995). Self-directed learning in business and industry: A review of the literature, 1983-1993. In H.B. Long & Associates, *New dimensions in self-directed learning* (pp. 367-381). Norman, OK: University of Oklahoma.

Lowe, C. (2009). *A correlational study of the relationship between learner autonomy and academic performance*. Unpublished PhD Thesis. George Washington University

McDaniel, T.R. (1994). College classroom of the future. *College Teaching*, *42(1)* 27-31.

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review, 98(2),* 224-253.

Masgoret, A. M. & Gardner, R. C. (2003). Attitudes, motivation, and second language learning: A meta-analysis of studies conducted by Gardner and Associates. *Language Learning 53*(S)*,* 167-210.

Mills, N., Pajares, F., & Herron, C. (2007). Self-efficacy of college intermediate french students: Relation to achievement and motivation. *Language Learning, 57(3)*, 417-442.

Moore, M. G., & Kearsley, G. (1996). *Distance education: A systems view*. Belmont, CA: Wadsworth Publishing Company.

Mortimer, V. R. (2000). *Composing ourselves: Ethos and the negotiation of teacher identity.* Unpublished PhD Thesis. The Ohio State University

Mukhamedyarova, Zh., & Cotter, M. (2005). Interactive methods of teaching as a condition for developing students' independent learning skills in Kazakhstan and the U.S. *International Education*, *34(2)*, 62-73.

Murphy, L. (2005). Critical reflection and autonomy: A study of distance learners of French, German and Spanish. In B. Holmberg, M. Shelley, & C. White (Eds.), *Distance education and languages: Evolution and change* (pp. 20-39). Clevedon: Multhingual Matters.

Neisi, S. (2007). *Relationship between self-esteem, achievement motivation, FLCA and EFL learners' academic performance*. Unpublished master's thesis. Shiraz University, Shiraz, Iran.

Noels, K.A., Clement, R., & Pelletier, L.G. (1999). Perceptions of teacher communicative style and students' intrinsic and extrinsic motivation. *Modern Language Journal*, *83*, 23–34.

Noels, K.A., Pelletier, L.G., Clement, R., & Vallerand, R.J. (2000). Why are you learning a second language? Motivation orientations and self-determination theory. *Language Learning*, *50*, 57–85.

Noels, K.A., Clement, R., & Pelletier, L.G. (2001). Intrinsic, extrinsic, and integrative orientations of French Canadian learners of English. *Canadian Modern Language Review*, *57*, 424–442.

Nortcliffe, A. (2005). Student-driven module: promoting independent learning. *ProQuest Educational Journal, 2(3),* 247-266.

Oller, J. W., Hudson, A.J., & Liu, P.F. (1997). Attitudes and attained proficiency in ESL: A sociolinguistic study of native speakers of Chinese in the United States. *Language Learning, 27(1)*, 1-27.

Peters, O. (1998). *Learning and teaching in distance education: Analyses and interpretations from an international perspective*. London: Kogan Page.

Ponton, M. K. (1999). *The measurement of an adult's intention to exhibit personal initiative in autonomous learning.* Doctoral dissertation, The George Washington University.

Pruitt, D. (2005). *Transactional distance and learner autonomy as predictors of student performance in distance learning courses delivered by three modalities.*Unpublished PhD Thesis. Graduate School of Tulane University.

Ramazanian, M. (1998). *The motivation for language learning among Shiraz University undergraduate students of English as a foreign language*. Unpublished master's thesis. Shiraz University, Shiraz, Iran.

Reeve, J., Jang, H., Harde, P., & Omura, M. (2002).Providing a rationale in an autonomy-supportive way as a strategy to motivate others during an uninteresting activity. *Motivation and Emotion, 26*, 183-207.

Reio, T. G. (2004). Prior knowledge, self-directed learning readiness, and curiosity: Antecedents to classroom learning performance. *International Journal of Self-Directed Learning, 1(1),* 18-25.

Reio, T. G., Jr., & Leitsch, P. K. (2003). A preliminary exploration of the relationship between self-directed learning and critical thinking. [CD-ROM]. (Available from http://www.sdlglobal.com ISBN 1-56946-069-8). In H. B. Long & Associates, *Current Developments in E-Learning & Self-Directed Learning* (pp. 185-196). Melrose, FL: International Self-Directed Learning Symposium.

Roohani, A. (2001). *An investigation into EFL students' motivation in Shiraz State and Islamic Azad University.* Unpublished master's thesis. Shiraz University, Shiraz, Iran.

Ruth, R. (2001). *Internet-based distance training for adult ESL learners: A framework for dynamic language learning*. Doctoral dissertation, School University of Toronto( Canada).

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, *57*, 749-761.

Ryan, R.M. 1991. The nature of the self in autonomy and relatedness. In *The Self: Interdisciplinary Approaches*, J. Strauss & G.R. Goethals (eds), 208–238. New York NY: Springer.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist,* 55(1), 68-78.

Salimi, R. (2000). *Affective factors in learning English: a study of the filter.* Unpublished master's thesis. Shiraz University, Shiraz, Iran.

Savington, S. J. (1983). *Communicative competence:Theory and Classroom Practice*. Massachusetts, etc. Addison – Wesley Publishing Company.Sifakis.

Savoie, M. M. (1979). *Continuing education for nurses: Predictors of success in courses requiring a degree of learner self-direction*. Unpublished doctoral thesis, University of Toronto, Canada.

Schmidt, R., Watanabe, Y. (2001). Motivation, strategy use, and pedagogical preferences in foreign language learning. In Z. Dörnyei & R. Schmidt (Eds.), *Motivation and second language acquisition* (Technical Report #23, pp 313-359). Honolulu: University of Hawai'I, Second Language Teaching and Curriculum Center.

Shelley, M. A. (2000). *Distance education in M S Byram (Ed) 2000*. Encyclopedia of Language Teaching and Learning. London: Routledge.

Shinge, M. (2005). *Interplay among anxiety, motivation, and autonomy in second language learners of French: A quantitative and qualitative study*. Unpublished doctoral thesis, The University of Florida.

Shroff, R.H, Vogel, D.R, & Coombes, J. (2008). Assessing Individual-level Factors Supporting Student Intrinsic Motivation in Online Discussions: A Qualitative Study. *Journal of Information Systems Education.* West Lafayette: Spring 2008. Vol. 19, Iss. 1; pg. 111, 16 pgs.

Simmons, D. (1996). A study of strategy use in independent learners. In R. Pemberton, et al. (eds), *Taking Control: Autonomy in Language Learning*. Hong Kong: Hong Kong University Press.

Skehan, P. (1989). *Individual Differences in Second Language Learning*. London: Edward Arnold.

Staton-Cross, D. L. (1988). *Realationship of learning styles, learning preferences, and learning autonomy among adult learners in two associate degree nursing programs: traditional and nontraditional*. Doctoral dissertation, Boston College.

Svanes, B. (1987). Motivation and cultural distance in second language acquisition. *Language Learning, 37,* 341-359.

Tonks, J.M.S. (2006). *Mixed-methods study of perceived academic autonomy in Japanese students and its relations to their motivation*. Unpublished PhD Thesis. University of Maryland, College Park.

Tremblay, P.F., & Gardner, R.C. (1995). Expanding the motivation construct in language learning. *Modern Language Journal, 79*, 505–20.

Trinh, Q.L. (2005). *Stimulating learner autonomy in English language education : A curriculum innovation study in a Vietnamese context.* Unpublished PhD Thesis. Graduate School of Teaching and Learning, University of Amsterdam.

Tross, S., Harper, J., Osher, L., & Kneidinger, L. (2000). Not just the usual cast of characteristics: Using personality to predict college performance and retention. *Journal of College Student Development*, *41(3)*, 323-334.

Ushioda, E. (1996). Developing a dynamic concept of L2 motivation. In Hickey, T., & Williams, J. (Eds), *Language, education and society in a changing world*, Dublin IRAAL, Clevedon, UK and Philadelphia, PA: Multilingual Matters.

Ushioda, E. (2003). Motivation as a socially mediated process. In D. Little, et al (Ed.), *Learner autonomy in foreign language classrooms: Teacher, learner, curriculum and assessment* (90-102). Dublin: Authentik.

Ushioda, E. (2006a). Motivation and autonomy in language learning. In M. Kötter, O, Traxel, & S. Gabel (Eds.), *Investigating and facilitating language learning. Papers in honour of Lienhard Legenhausen*. Trier: Wissenschaftliger Verlag Trier.

Ushioda, E. (2006b). Motivation, autonomy and sociocultural theory. In P. Benson References 86(Ed.), *Learner autonomy 8: Insider perspectives on autonomy in language learning and teaching* (pp. 5-24). Dublin: Authentik.

Vanijdee, A. (2003). Thai distance English learners and learner autonomy. *Open Learning, 18 (1)*, 75-84.

Victori, M., & Lockhart, W. (1995). Enhancing metacognition in self-directed language learning. *System, 23(2)*, 223-234.

Vygotsky, L.S. (1978). *Mind in Society: the Development of Higher Psychological Processes.* Harvard University Press.

Wang, S.C., & Palincsar, A.S. (1989). Teaching students to assume an active role in their learning. In M.C. Reynolds (Ed), *Knowledge Base for the Beginning Teacher.* Oxford: Pergamon Press.

Wang, M.C. & Peverly, S. T. (1986). The self-instructive process in classroom learning contexts. *Contemporary Educational psychology 11*, 370-404.

Wegner, S. B., Holloway, K. C., & Garton, E. M. (1999). The effects of internet-based instruction on students learning. *Journal of Asynchronous Learning Networks, 3(2).*

Wenden, A. (1995). Learner training in context: a task-based approach to promoting autonomy. *System, 23(2),* 183-194.

White, C. (1995). Autonomy and strategy use in distance foreign language learning: research findings. *System*, *23(2)*, 207-222.

White, J. (1999). In defense of liberal aims in education. In R. Marples (Ed.), *The aims of education* (185-200). London: Routledge.

White, C. (2003). *Language learning in distance education*. Cambridge: Cambridge University Press.

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**Editor's Note**: This is a study of mathematics software for mathematics education. The findings should be valuable to teachers and curriculum experts in designing, selecting and using software to meet specific teaching and learning requirements, especially in service courses for non-math students.

# Tertiary students learning mathematics online: Guidelines for selecting effective software

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Many tertiary courses such as nursing and psychology require competency and knowledge of mathematics. While most universities provide assistance through student learning centres, only so much can be done in one-on-one settings to support students who need to refresh their mathematics skills. Today's students live in a technological world where the use of technology permeates almost every aspect of their lives. One question that arises in this context is how computer software can best be used to facilitate student learning of mathematics. In particular, what distinguishes more from less effective software? This paper discusses research in both mathematics education and educational software. As a result, a list of characteristics is proposed to guide the selection of effective software for teaching and learning mathematics. The characteristics are of potential benefit to both Mathematics Learning Centre and content lecturers.

**Keywords**: mathematics teaching, mathematics learning, software design, pedagogy, tertiary education, Technological Pedagogical Content Knowledge (TPCK), educational software

## Introduction

Many students seek additional support beyond the regular classroom experience. The impetus for this paper arose from a need to find appropriate software to support student learning in tertiary studies. The majority of students seeking help in University mathematics learning centres are non-mathematics majors requiring mathematics as a part of their study. Students come from a wide range of courses including nursing, psychology, business, science, and teacher education. The level of mathematics they need help with would usually be assumed knowledge for many University courses; their lack of knowledge can reflect a choice in high school not to study mathematics at senior level, or a gap of several years between completing high school and starting university, or a lack or perceived lack of mathematics competency that extends to such basic skills as long division and arithmetic with fractions.

Learning centres can offer limited one-on-one tuition, but students often require more time to effectively learn the mathematics needed for their courses. Software that allows independent learning can provide much needed additional support for such students, especially when that software is well-integrated within an overall teaching and learning program. To best facilitate learning, characteristics of mathematics learning and software need to be considered in tandem. A framework that can be applied to the identification of effective mathematics software is provided by *Technological Pedagogical Content Knowledge* (TPCK) (Mishra & Koehler, 2006).

Using the TPCK framework, this paper aims to integrate research from the fields of mathematics education, pedagogy, and technology. Mathematics educators may well be unfamiliar with technology, and technology designers unfamiliar with mathematics pedagogy; both groups may be unfamiliar with fundamental psychological principles about how the human brain learns. Educators in fields such as nursing where basic mathematics is used, for example, for drug calculations, may be unfamiliar with both mathematics and technology.

The primary contribution of the paper is a list of characteristics that can be used to guide the selection of effective software for the teaching and learning of mathematics. TPCK provides the

underlying framework for discussion of the characteristics. The relevance of each characteristic is illustrated by showing how software also combines pedagogy, content, and technology in ways that enhance learning.

## What is Technological Pedagogical Content Knowledge?

TPCK (Mishra & Koehler, 2006) refers to a complex, situated form of knowledge needed for thoughtful pedagogical use of technology. TPCK provides theoretical grounding for the use of educational technology in the form of a conceptual framework. Mishra and Koehler build on Shulman's (1986) formulation of Pedagogical Content Knowledge (PCK) to argue that effective integration of technology in teaching requires understanding the complex interplay among three key components of learning environments: content, pedagogy, and technology. TPCK emphasizes contextual knowledge that lies in the intersection of content, pedagogy, and technology, rather than viewing these areas in isolation.

TPCK represents a class of knowledge that is central to teachers' work with technology, yet that knowledge is not necessarily held by specialists in either teaching, or software, or mathematics. TPCK draws on PCK and two other frameworks. PCK refers to pedagogical knowledge as it is applied to the teaching of particular content. As well as key content in their area, a teacher needs to know the ways of representing and formulating their knowledge that make it most understandable to students, given the different conceptions and preconceptions that students of different ages and backgrounds bring to the topic (Shulman, 1986). Technological Pedagogical Knowledge (TPK) refers to knowledge "of the existence, components, and capabilities of various technologies" (Mishra & Koehler, 2006, p. 1028) and how they are used within a teaching and learning environment. For example, access to an online forum may facilitate a pedagogical approach that emphasizes peer learning. Technological Content Knowledge (TCK) refers to knowledge about the reciprocal relationship between technology and content; how the use of particular technology shapes content, and how content can be shaped by technology. For example, teaching in a technological environment where animated simulations are available may change the way specific content can be taught; a simulation can visually and dynamically show how changes in the y-intercept and slope of a straight line correspond to changes in both the algebraic equation of the line and its graphical representation.

The TPCK framework emphasizes that *the whole is more than the sum of the parts*; while a combination of PCK, TPK, and TCK give rise to TPCK, TPCK itself is more than any simple sum of the knowledge in the other three areas. A result of the TPCK emphasis on intersecting areas of knowledge is a focus on the importance of *how* technology is used, rather than on *what* teachers need to know to incorporate technology into their teaching. (Warschauer, 2007) notes that software is best used in conjunction with face-to-face teaching. The premise of this article is that software is most effectively used as one component of an overall teaching and learning program; we aim to provide teachers with a list of characteristics that may better enable them to select and work with technology and, in doing so, may improve their TPCK.

This article uses the TPCK framework, through reference to pedagogy, content and technology, to explore the use of software to support the learning of mathematics. The following sections highlight features of software that support key learning and mathematics learning principles. Specific examples of software are provided to illustrate the use of software to provide students with effective learning support.

## Characteristics of effective mathematics pedagogy and software

Anthony and Walshaw's (2008) extensive literature review identifies characteristics of effective mathematics pedagogy. We have selected the following items from their list as being universally

relevant for learners in a range of situations: (a) creating appropriate task challenge; (b) use of tools and representations; (c) meaningful tasks that promote student engagement; (d) providing cognitive structure for students' ideas; and (e) providing appropriate feedback.

Wood (2008) explains that it is important to delve beneath mathematics software to examine the learning framework used to develop the tool: "A software tool may be successful because it forces a certain style of learning that is effective, not because it is software" (L. Wood, 2008, p. 91). Too often, software does not make good use of available technological advantages to enhance learning (Oliver, 1999). In current literature, key attempts to change this have usually focused on developing models, frameworks, and/or principles to guide the incorporation of relevant pedagogy into online learning (R. Clark, 2002; Conole, Dyke, Oliver, & Seale, 2004). Perhaps the most significant of these, at least for the users and designers of software, are Clark and Mayer's (2003) principles for multimedia learning. These principles are based on substantial research into how the human brain works most effectively and are articulated as clear, practical principles that users and designers of online tools can make use of in their work.

Much of Clark and Mayer's work draws on the importance of paying attention to the limited capacity of human working memory (Raskin, 2000) when designing software. Based on current psychological research, they outline principles for designing effective e-learning software. Their key principles for multimedia design are as follows:

- *The Multimedia Principle*: using both words and graphics generates deeper learning than words alone.
- *The Contiguity Principle*: aligning words to corresponding graphics facilitates deeper learning, because a learner can see both representations of information at the same time.
- *The Modality Principle*: speaking words in preference to displaying them, when accompanying graphics, fits better with how the human brain works, because information flow through the visual and auditory channels is optimized.
- *The Redundancy Principle*: explaining pictures using *either* words *or* text, but not both, is more effective. Learners process more efficiently when the flow of information through the visual and auditory channels is balanced and *optimal*.
- *The Personalization Principle*: using a conversational presentation style works better than a formal one, because a conversational style prompts a social response that activates cognitive processing, and this leads to increased learning.
- *The Segmenting and Pre-training Principles*: breaking a lesson into parts is important for managing complexity. People learn more deeply when information is presented in learner-paced segments rather than continuously, because cognitive processing takes time.

Four significant characteristics of effective software for mathematics teaching and learning have been identified, based on our multidisciplinary research. The following four sections each highlight one characteristic. The relevance of each characteristic is illustrated by showing how software that incorporates the characteristic combines aspects of TPCK in ways that enhance learning.

## The software takes a patterns-based approach to mathematics

The characterization of mathematics as the science of patterns dates back to Polya's (1962) seminal work where he argued that effective problem solving is more about being a good guesser and recognising underlying patterns than about applying standard, learned techniques. Polya states that

mathematics teaching needs to *teach to think* rather than merely impart information. He argues that students need to learn how to problem solve by discovering, using guesswork and heuristics:

> Solving problems is a practical art, like swimming, or skiing, or playing the piano: you can learn it only by imitation and practice. … If you wish to derive the most profit from your effort, look out for such features of the problem at hand as may be useful in handling the problems to come. A solution that you have obtained by your own effort or one that you have read or heard, but have followed with real interest and insight, may become a *pattern* for you, a model that you can imitate with advantage in solving similar problems. (Polya, 1962, p. v)

Schoenfeld (1992) builds on Polya's and others' work in his writing on learning to think mathematically. He notes that the focus of much mathematics education has primarily been on content, facts, and procedures; mathematics knowledge is understood as content-based rather than being a capacity to think independently. Schoenfeld points out, however, that more recently there has been a significant change in the way which mathematics is conceptualised; mathematics is now being conceptualised as the science of patterns:

> Traditionally one defines what students ought to know in terms of chunks of subject matter, and characterizes what a student knows in terms of the amount of content that has been "mastered". As natural and innocuous as this view of "knowledge as substance" may seem, it has serious entailments … Over the past two decades there has been a significant change in the face of mathematics … and in the community's understanding of what it is to know and do mathematics … The main thrust of this reconceptualization is to think of mathematics, broadly, as "the science of patterns".
> (Schoenfeld, 1992, pp. 25-28)

The importance of "bridging" or "reflection" to problem solving in mathematics is highlighted by Adey and Shayer (1994, pp. 71-73). Bridging involves relating new concepts to other examples in science, mathematics, or everyday life, and encourages students to recognise underlying similar problem-solving techniques applying in different contexts. The ability recognize patterns is critical to the ability to apply learned theoretical knowledge appropriately in different situations. Further, Adey and Shayer argue that the ability to do the pattern recognition is facilitated by explicitly articulating the patterns; if bridging is the conscious transfer of a reasoning pattern from a context in which it is first encountered to a new context, then the transfer is most likely to be effective if the reasoning pattern has been made conscious and verbalised.

Thus, software that recognises the importance of patterns to learning mathematics ought to be designed so that students do not simply learn by rote and calculate answers to simplistic problems according to techniques they have been told to apply. Software should focus on teaching to think—teaching patterns and problem solving, rather than applying rules to get answers. Software needs to provide genuine problem solving opportunities (Clark & Mayer, 2003), where students become aware of the patterns underlying kinds of problems and learn to recognise them, instead of simply applying a relatively random rule to compute an answer.

One example of software that does this well is the commercial software program *Maths Island* by Macroworks (2008). *Maths Island* teaches basic competency in addition, subtraction, multiplication, and division. Perhaps the most important concept or pattern for learners to acquire in this context is the notion that an equals sign represents balance. This is a key foundation for more advanced algebraic work including rearranging and solving equations. *Maths Island* teaches this pattern by subtly changing the format of problems in the problem sets that learners work through. Initial problem sets are formatted in a left-to-right text style, reading fashion; for example, *6 + 2 = ?*. More advanced problem sets appear in other formats. One format is vertical, with the equal sign scribed as a line under which the solution is written. Other formats are

variations on the initial horizontal format, but this time with multiple numbers: *6 + 2 = ? + 5* or where the missing number might be on the other side of the equals sign: *6 + ? = 4 + 3*. While rearranging problem format might seem trivial it is important for teaching the learner that balance is the critical factor in solving these equations, rather than the particular position of any of the numbers. Without this understanding of equals as balance, students often think that the equals sign is simply shorthand for "the answer is"; when students come to learn algebra, an understanding of equals as balance becomes critical.

Software that encourages the teaching of mathematics by recognising and highlighting key patterns embodies good PCK, because underlying the software is knowledge about both key concepts and how those concepts are best taught. For example, in the case of arithmetic, teaching arithmetic effectively means not only knowing how to do, say, addition, but also knowing that students need to be taught addition in such a way that they understand the key underlying conceptual pattern that equals means balance. This is what *Maths Island* does well and the reason *Maths Island* demonstrates good PCK.

In summary, effective software for mathematics teaching does not just present rules and problems but also identifies and emphasizes key patterns underlying those problems. This helps a teacher using that software teach more effectively, and facilitates the learner's ability to recognise patterns and hence the ability to judiciously apply knowledge across different contexts.

## The software provides and links multiple representations

Many authors have noted the importance of working with multiple representations to the development of effective problem solving skills. Wieman and Perkins (2006) point out that making connections between multiple representations of problems and solutions is a key skill of expert scientists. Duval (2006, p. 107) argues that mathematical information is only accessible through representations, and that learning to link between multiple representations is critical for learning mathematics: "the ability to change from one representation system to another is very often the critical threshold for progress in learning and for problem solving". Wood, Joyce, Petocz, and Rodd (2007) argue that in a lecture-based learning context, providing different representations of a mathematics problem and facilitating students' linking between those representations forms the basis for deep learning and fluency with mathematical ideas. Wood (2008) cites Jacobs (2005), who advocates the use of visual representations of concepts to support student learning. According to Wood, "[c]omputers and web-based applications can provide an avenue for visual presentation particularly when allied with interactive tools and animation".

In a technological context, Clark and Mayer's (2003) *Multimedia Principle* reinforces the need for using both words and graphics in tandem to explain a concept. Clark and Mayer note that the combination of words and appropriate graphics provides different representations of material and so facilitates learners engaging in relevant cognitive processing that deepens learning. Ainsworth (2008) focuses on multimedia learning environments and notes that if students only ever work with one representation of a problem, their understanding of the problem is likely to be limited by that representation; providing multiple representations of a problem is one way of highlighting underlying patterns. However, Ainsworth also cautions that simply providing multiple representations does not necessarily increase learning. A number of factors influence whether multiple representations are effective; one key factor is whether students are able to link between different representations.

In order for software to provide and link between multiple problem representations, it must explicitly articulate those links, rather than simply provide different representations and assume the student will make connections between them. With respect to words and graphics, a key point highlighted by Clark and Mayer is that the best graphics do more than represent single objects;

they help the learner understand material by highlighting transformations or relationships that are either organisational or otherwise invisible. One application that illustrates this is *Algebra Balance Scales – Negatives* from the National Library of Virtual Manipulatives (Utah State University, 1999-2010). The software allows users to dynamically build a visual representation of an algebraic equation, such as $x + 2 = 3x - 5$. The visual representation of the equation uses a balance scale with labelled building blocks to represent *x* and *1* values, and labelled balloons to represent *negative x (-x)* and *negative one (-1)* values, as shown in **Error! Reference source not found.**. The scale is balanced when the correct number of blocks and balloons are placed on each side. Removing a block from one side of the scale elevates that side; in contrast, removing a balloon from one side pushes that side down; the scale is balanced when the equation is correctly represented. The labels on blocks and balloons explicitly link the equation text to its visual representation. The movement of the balance scale as blocks and balloons are removed highlights a key difference between the positive and negative numbers they represent – namely, that removing a negative number from one side of an equation adds to the value of that side, whereas removing a positive number decreases the value. This could be further enhanced by a textual representation of the equation being adjusted accordingly as blocks and balloons are added and removed from the scale, as indicated by Clark and Mayer's (2003) Contiguity Principle.

The use of the balance scale to represent the equations is an example of good PCK; many students who are confused by algebraic equations understand how balance scales work. Computer animation enables dynamic visual representation of algebraic equations and is an example of good TCK; awareness of the potential of the technology enables content to be taught using this visual simulation.

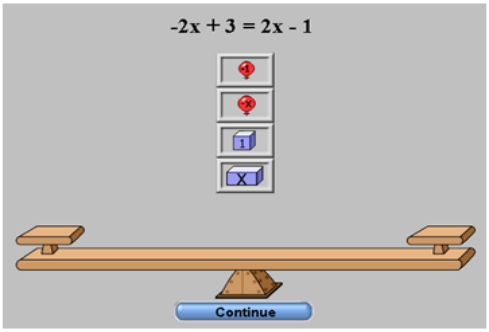
Effective software for mathematics teaching provides and links multiple representations because this is a key problem solving skill. Students who learn to move between multiple representations are more likely to achieve deeper learning. A teacher evaluating software needs to recognize the importance of providing and linking multiple representations, identify which representations are likely to be more helpful for their students, and work with the software in such a way that key multiple representations present in the software are further emphasized and linked.

### *The software provides appropriate feedback and scaffolding*

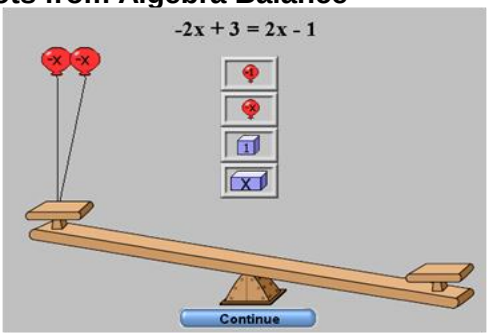
Wiliam's (2007) extensive literature review indicated that feedback in mathematics is frequently ineffective. Weak or relatively ineffective feedback may involve simply providing the student with results. Wiliam cites Nyquist (2003) as stating that feedback research applies across all age groups and levels of education and is equally important in higher education. Nyquist further classified feedback on a continuum ranging from weak to strong. An example of weak feedback is as follows: a student may undertake a series of 10 algebra questions and at the conclusion be informed that they achieved 5 correct answers. Strong feedback provides information about correct answers accompanied by an explanation and additional activities to further support learning.

Wiliam (2007, p. 1072) states that, "where feedback engages students in mindful activity, the effects on learning can be profound". Wiliam cites evidence of positive connections between constructive feedback and higher student results. Constructive feedback includes specific comments about errors and suggestions for further work. Likewise negative or weak feedback is associated with lower student results.

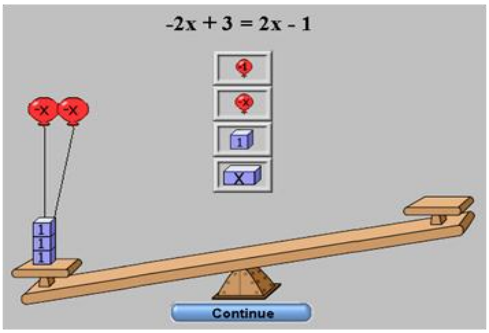
## Successive Screenshots from Algebra Balance



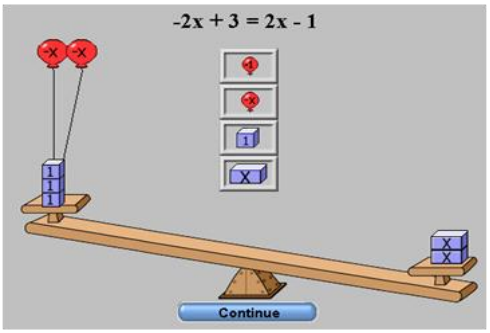

1. Initial presentation: the scale is balanced and empty.



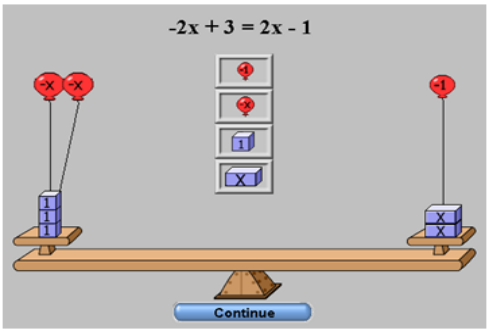

2. Two "negative x" balloons have been placed on the left of the scale, lifting that side upwards.



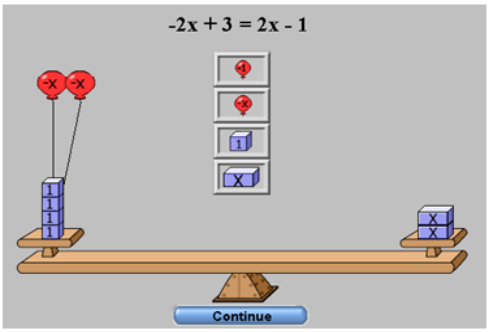

3. Now three "positive unit" values have been added to the left of the scale, sinking that side down.



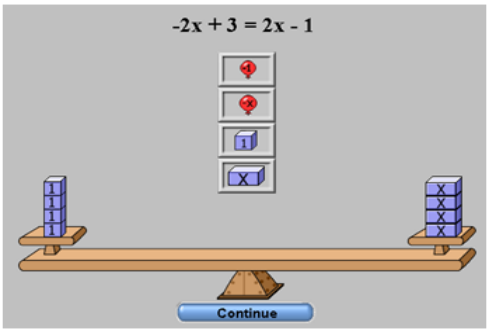

4. Two "positive unit" values have been added to the right of the scale, and that side is now the heaviest.




5. One "negative unit" value has been added to the right of the scale. The algebraic equation is now correctly represented and the scale is balanced.




6. One "negative unit" value has been removed from one side (right) of the scale and one "positive unit" block added to the other side (left), keeping the scale balanced.




7. Two "negative x" values have been removed from one side (left) of the scale and two "positive x" blocks added to the other side (right), keeping the scale balanced. It is now evident that "positive x" and "positive unit" blocks weigh the same, and the solution to the algebraic equation is x=1.

**Figure 1: Using *Algebra Balance Scales – Negatives* to visualize and solve an algebraic equation**

"Feedback ought to be analytical, to be suggestive, and to come at a time when students are interested in it" (Rutherford & Ahlgren, 1989-1990). If feedback is provided before a student has a chance to think about and attempt a problem, less learning is likely to result. Feedback should provide guidance but not remove a student's opportunity to think about and actively engage with the problem. This links directly with the concept of scaffolding the learning for students. Kiong and Yong (2005) describe scaffolding as support to allow a learner to achieve an outcome that they could not accomplish unassisted. While scaffolding is normally used with reference to teacher support, it can be applied to the learning support provided within software. Ultimately the aim is for the learner to be able to complete the task unassisted.

Existing software provides a wide variety of feedback and scaffolding. For example, *Maths Online* ("Maths Online," 2011) is a freely available and widely used mathematics software program. While it is attractive and has a range of activities, it does not appear to provide very strong feedback to promote student learning. Students must complete whole sets of exercises in order to get any feedback, and then are simply informed whether their answers are correct or incorrect. In contrast, *Maths Island* software pretests users and individualises the activities and problems. This software gives immediate visual feedback that includes specific information about where in the problem solving process the error occurred. Colour is used to highlight the error and to visually explain the correct solution.

One example of software that provides useful feedback is The Learning Federation game *Scale Matters*. The game requires users to estimate the position of a number on a number line with no marked units of scale, as shown in Figure 2. If the user gets the right answer, they can go on to the next question. If not, then feedback and scaffolding come into play, and the user is asked to first choose an appropriate scale ruler for the number line, and then try again to mark the correct position of the number on the now scale-marked number line, as shown in the bottom two screenshots of Figure 2. This demonstrates excellent PCK, because while learning how to estimate, perhaps the most critical skill for mathematics (Halberda, Mazzocco, & Feigenson, 2008), the learner is being provided both feedback (Rutherford & Ahlgren, 1989-1990) and scaffolding (Kiong & Yong, 2005) in a way that is pedagogically effective. It demonstrates good TCK, because the technology is used well to facilitate the teaching of estimation; for example, after an unsuccessful attempt, pictures of rulers of different scale are offered to the user, who is asked to choose the most appropriate one. From the PTK angle, the use of technology to provide feedback after the initial attempt is important; scale is dynamically added to the number line only after an initial unsuccessful attempt.

Rescue the Zogs (MathPlayground.com, 2010) also provides effective feedback; it focuses on learning about straight lines and their slopes, intercepts, and equations. Each time the user makes an incorrect guess at, for example, the equation of a straight line, a brief hint – in the form of a line of Zogs – flashes quickly on the screen and then disappears. Again, the feedback comes after an initial attempt and the technology is used to provide effective feedback in a way that would be much more difficult without the technology; this demonstrates good PTK. This program demonstrates Clark and Mayer's Contiguity principles by positioning together on the screen corresponding and continuously updating textual and graphical representations of a straight line.

Both scaffolded learning and excellent feedback for students is provided by an on-line instructional program entitled *Factoring by the Difference of Two Perfect Squares* (DOPS) (Peterson, 2002). This on-line program effectively incorporates Clark and Mayer's principle of segmenting and pre-training by providing appropriate explanation in a series of logical steps. People learn more deeply when they are aware of the names and characteristics of main concepts because this reduces the amount of cognitive processing required at the time they are learning about those concepts. For this reason, DOPS demonstrates some elements of good PTK; the technology is used to provide dynamic feedback in small steps, rather than continuously.

**Successive Screenshots from The Learning Federation game Scale Matters**

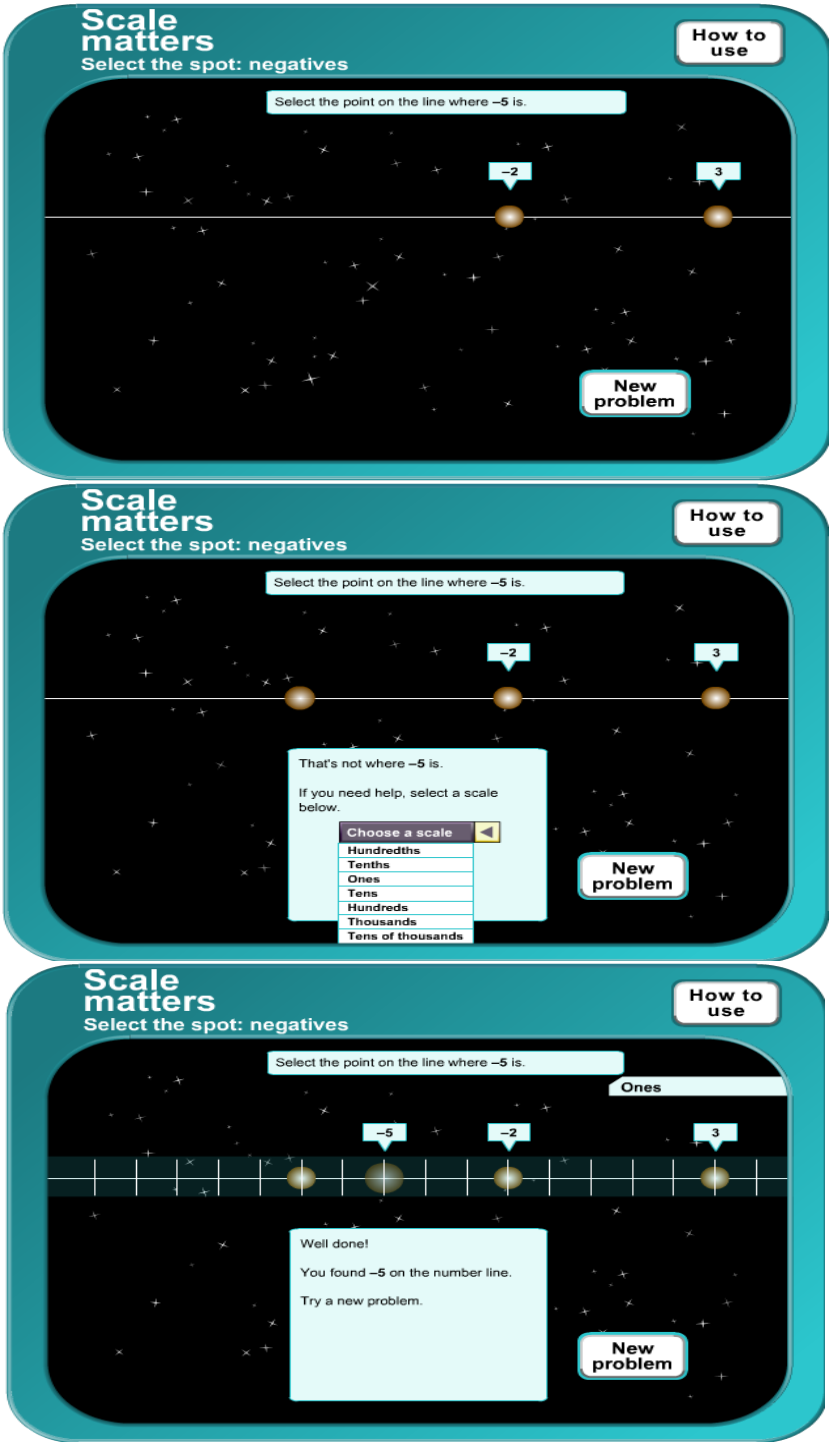



**Figure 2: In the first screenshot (top), the user is asked to estimate the location of -5 on the number line, based on the given locations of -2 and 3. The second shot (middle) shows the screen where the user has incorrectly located -5 and is being invited to choose an appropriate scale to help them with the problem. In the final screen (bottom), the user has correctly positioned -5 with the help of vertical scale markers placed at the selected interval (ones) on the line.**

In other ways, DOPS demonstrates inadequate PTK; for example, theoretical explanations of concepts are not visible at the same time as the user is working on examples; this violates Clark and Mayer's Contiguity Principle.

## The software facilitates student engagement in learning

Ingram (2005) defines engagement as including three critical factors: deep attention to learning and related activities; activation of effective cognitive processes, so both learning and task performance are improved; and usually, a social context, especially when collaboration is part of learning. Carmean and Haefner (2002) note that engagement is a key factor promoting deeper learning, and that important hallmarks of engaged learning are the accommodation of "diverse talents and ways of learning", communication of high expectations, an environment that is one of high challenge and low threat, and an emphasis on "intrinsic motivators and natural curiosities". Current pedagogical research suggests that in order for technology to be an effective teaching tool, it must facilitate student engagement in learning rather than just provide information (Brill & Park, 2008). Davies and Graff (2005) found first year undergraduate business students who failed, spent a significantly lower proportion of time in the group and communication sections of the course's website. Wood (2008) cites (Jacobs, 2005) that on-line teaching tools can provide students with both enjoyment and a sense of achievement. Clearly such feelings encourage continued engagement by the students and potentially result in increased learning. Many authors including Clark (2002) and Mayer (2004) note that active learning is necessary for deep learning to take place. For this reason, *guided* active learning is one technique often recommended as a way of significantly increasing engagement and student learning. Clark and Mayer (2003) offer four helpful principles for guided active learning: (a) more control is best given to advanced rather than novice learners; (b) important instructional events should be default control choices so that an explicit choice is required to bypass them; (c) adaptive control (where the program adjusts content according to user responses) should be considered; and (d) information should be segmented so that learners can have control over the pace of their learning.

Many of the features of *Maths Island* promote engaged learning according to the hallmarks defined by Carmean and Haefner (2002). One way that diverse learning styles are accommodated is through the presentation of different problem representations, both visual and textual, in the Training Room, as shown in Figure 3. Another way is through the inherent flexibility within the program. The progression path through each operation (add, subtract, multiply, divide) is independent. This means, for example, that students are free to work through all ten of the addition levels (each of which has four sublevels) before tackling any other operations, or conversely could complete the first level of all operations before proceeding to the next. High expectations are communicated, for example, by the requirement of an achievement of 80% accuracy in any sublevel to progress to the next sublevel. One way that a high-challenge environment is emphasized is through the many, gradually more difficult instructional levels available; the challenge for the student is to complete each of four sub-levels and then progress to the next level. The initial placement test ensures that each student starts at a level with challenge appropriate to their skill and the opportunity for doing tests in each area of competence adds to the sense of challenge. A low threat environment is created through the lack of any consequence for mistakes apart from the useful feedback of a sad face informing the learner that the answer is wrong, and the logical consequence of not being able to progress to the next level if too many mistakes are made. A sublevel can be retried at any time, and as many times as necessary.

## Maths Island Training Room: Multiplication

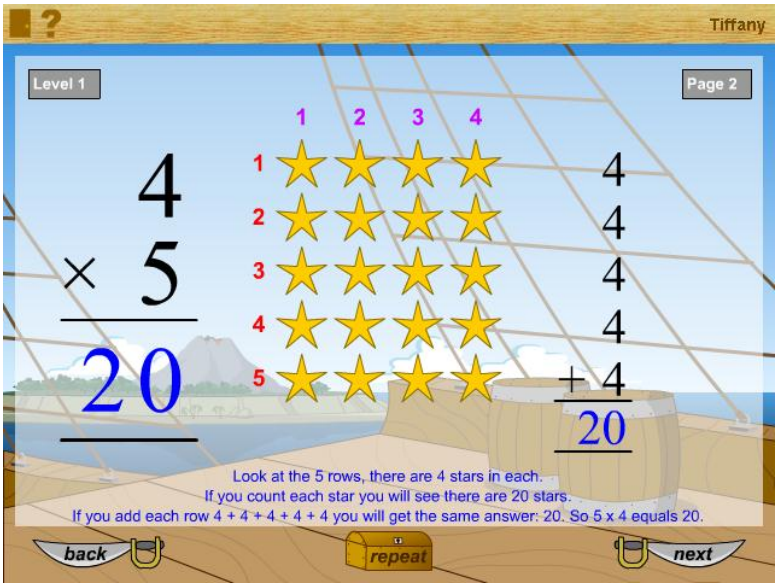



**Figure 3: visual and numeric representations of multiplication and its relationship to addition**

While it is difficult to evaluate intrinsic motivators, the guided active learning provided in *Maths Island* ensures that tasks are of an appropriate level to interest a particular learner. With respect to Clark and Mayer's principles for guided active learning, students in *Maths Island* who want to skip initial instructional levels are required to take a placement test and can only skip levels if they demonstrate appropriate proficiency, consistent with both (b) and (c) above. Information is clearly segmented into areas as suggested in (d) above; for example, Training Room is where students go for extra help when they cannot pass a level, and each level includes signposts to exercise groups focusing on different areas. The only principle *Maths Island* does not address is (a); all students have the same control. This is not necessarily a problem, because it may be that if a student has achieved Level 9, it is important to know that they have also mastered concepts covered in lower levels.

## Conclusion

Learning is clearly a complex, multi-faceted endeavour. Learning mathematics is often perceived as being particularly difficult for many students. Tertiary students required to study mathematics as a service subject in fields such as nursing, business, and psychology frequently require significant support. Part of their learning can be achieved through effective mathematics software, provided that the software is pedagogically sound. We have examined the effectiveness of software from a pedagogical point of view using the TPCK framework.

The contributions of this paper are:

- the identification of a list of characteristics to guide the selection of effective software for teaching and learning mathematics
- the recognition and use of TPCK as an underlying framework for such characteristics
- the illustration of the presence of the characteristics in selected existing software.

Effective mathematics software should embody the following characteristics: a patterns-based approach to mathematics teaching, multiple representations of key concepts, specific feedback with appropriate scaffolding, and facilitation of student engagement. Clark and Mayer's (2003)

principles are critical to the effectiveness of the characteristics as implemented in software. This includes attention to layout, graphics together with text, and opportunities for rich user interaction with the application.

We suggest that the more characteristics a software program exhibits, the more effective it is likely to be for facilitating mathematics learning. This list does not yet provide a definitive test of whether such software facilitates student learning of mathematics as further work is needed to quantitatively establish the merit of these characteristics.

## References


Adey, P., & Shayer, M. (1994). *Really Raising Standards: Cognitive Intervention and Academic Achievement*. London, UK: Routledge.

Ainsworth, S. (2008). How should we evaluate multimedia learning environments? In J.-F. Rouet, R. Lowe & W. Schnotz (Eds.), *Understanding Multimedia Comprehension*. New York, USA: Springer.

Anthony, G., & Walshaw, M. (2008). Characteristics of Effective Pedagogy for Mathematics Education. In H. Forgasz, B. Anastasios, A. Bishop, B. Clarke, S. Keast, W. T. Seah & P. Sullivan (Eds.), *Research in Mathematics Education in Australasia* (pp. 195-222). Rotterdam, The Netherlands: Sense Publishers.

Brill, J. M., & Park, Y. (2008). Facilitating Engaged Learning in the Interaction Age. *International Journal of Teaching and Learning in Higher Education, 20*(1), 70-78.

Carmean, C., & Haefner, J. (2002). Mind over matter: Transforming course management systems into effective learning environmnets. *Educause Review*(November/December), 8.

Clark, D. (2002). Psychological Myths in E-Learning. *Medical Teacher, 24*(6), 598-604.

Clark, R. (2002, September 10, 2002). Six Principles of Effective e-Learning: What Works and Why. *Learning Solutions e-Magazine*, from http://www.eLearningGuild.com

Clark, R. C., & Mayer, R. E. (2003). *e-Learning and the Science of Instruction* (second ed.). San Francisco, California, USA: John Wiley & Sons, Inc.

Conole, G., Dyke, M., Oliver, M., & Seale, J. (2004). Mapping pedagogy and tools for effective learning design. *Computers and Education, 43*(1-2), 17-33.

Davies, J., & Graff, M. (2005). Performance in e-learning: online participation and student grades. *British Journal of Educational Technology, 36*(4), 657-663.

Duval, R. (2006). A Cognitive analysis of problems of comprehension in a learning of mathematics. *Educational Studies in Mathematics, 61*, 103-131.

Halberda, J., Mazzocco, M., & Feigenson, L. (2008). Individual differences in non-verbal number acuity correlate with maths achievement. *Nature, 455*, 665-668.

Ingram, A. L. (2005). Engagement in Online Learning Communities. In J. Bourne & J. C. Moore (Eds.), *Elements of Quality Online Education: Engaging Communities* (Vol. 6). Needham, MA: Sloan Consortium.

Jacobs, K. (2005). Investigation of inveractive online visual tools for the learning of mathematics. *International Journal of Mathematical Education in Science and Technology, 36*(7), 761-769.

Kiong, L., & Yong, H. (2005). *Scaffolding: A teaching strategy for mathematics.* Paper presented at the ICMI Regional Conference - The Third East Asia Regional Conference on Mathematics Education (EARCOME): Foundations and creativity: The strengths and weaknesses of mathematics education in East Asia, East China Normal Univeresity, Shanghai, Nanjing and Hangzhou, China.

Macroworks. (2008). Maths Island 1. Brisbane, Australia: Macroworks.

MathPlayground.com (Producer). (2010). Save the Zogs. Retrieved from http://www.mathplayground.com/SaveTheZogs/SaveTheZogs.html

. Maths Online. (2011) Retrieved 2011, from http://www.mathsonline.com.au/

Mayer, R. E. (2004). Should There Be a Three-Strikes Rule Against Pure Discovery Learning? The Case for Guided Methods of Instruction. *American Psychologist, 59*(1), 14-19.

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record, 108*(6), 1017-1054.

Nyquist, J. (2003). *The benefits of reconstruing feedback as a larger system of formative assessment: a meta-analysis.* Master of Science, Venderbilt University, Nashville, TN.

Oliver, R. (1999). Exploring strategies for online teaching and learning. *Distance Education: An International Journal, 20*(2), 240-254.

Peterson, R. (2002). Factoring by the Difference of Two Perfect Squares Retrieved September 22, 2009, 2009, from http://www.wisc-online.com/objects/index_tj.asp?objID=TMH1001

Polya, G. (1962). *Mathematical discovery: on understanding, learning and teaching problem solving: Volume 1*. New York, New York, USA: John Wiley & Sons, Inc.

Raskin, J. (2000). *The Humane Interface: New Directions for Designing Interactive Systems*. Reading, Massachusetts, USA: Addison-Wesley.

Rutherford, F., & Ahlgren, A. (1989-1990). Effective teaching and learning: Principles of learning and teaching science, mathematics and technologyScience for All Americans Online: American Association for the Advancement of Science.

Schoenfeld, A. H. (1992). Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics. In D. Grouws (Ed.), *Handbook for research on mathematics teaching and learning*. New York, New York, USA: MacMillan.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-41.

Utah State University. (1999-2010). Algebra Balance Scales - Negatives - NVLM Retrieved October 4, 2011

Warschauer, M. (2007). The paradoxical future of digital learning. *Learning Inquiry, 1*(1), 41-49.

Wieman, C. E., & Perkins, K. K. (2006). A powerful tool for teaching science. *Nature Physics, 2*, 290-292. doi: 10.1038/nphys283

Wiliam, D. (2007). Keeping learning on track: Classroom assessment and the regulation of learning. In F. Lester (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 1053-1098). Charlotte, NC: Information Age Publishing.

Wood, L. (2008). University Learners of Mathematics. In H. Forgasz, B. Anastasios, A. Bishop, B. Clarke, S. Keast, W. T. Seah & P. Sullivan (Eds.), *Research in Mathematics Education in Australasia* (pp. 73-98). Rotterdam, The Netherlands: Sense Publishers.

Wood, L. N., Joyce, S., Petocz, P., & Rodd, M. (2007). Learning in lectures: multiple representations. *International Journal of Mathematical Education in Science and Technology, 38*(7), 907-915.

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**Editor's Note:** This paper shows that collaborative learning with a wiki is influenced by instructor decisions about structure and guidance as the Wiki evolves.

# Collaborative Wiki Creation in a Graduate Course: Aligning Wiki Design with Task Selection

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**USA**

## Abstract

Wiki use in two graduate mathematics education courses was researched within the Design-Based Research paradigm. Both instructor and students reported that the pre-determined wiki design (e.g., page & heading names) was an obstacle to the creation of a useful and organized wiki free of redundancy. In consecutive semesters, two different wiki design paradigms, chronological and thematic, were used. The impacts of those differing designs—as perceived by instructor and students and as revealed in the resulting wikis—suggest that the instructor's decisions about wiki structure and wiki-based tasks largely determine the utility of the wiki. The development of wikis as online tools which support collaborative knowledge construction would be supported by a continued investigation of design principals, effective tasks, and assessment strategies (and how they support each other).

*Keywords*: Wikis, design-based research, higher education, education, mathematics education.

## Introduction

There are compelling reasons to use wikis as instructional tools. They have great promise as venues for collaboration, as knowledge repositories, and as assessment devices. In 2010, the author was the instructor of a graduate mathematics education course at a large masters-granting university in the western United States. The construction and maintenance of a wiki (by the students and instructor) was a central task of the course. That is, the students and instructor jointly created a website with multiple linked pages which served as a knowledge repository for the content of the course. For all involved, this was a new experience that was accompanied by unfamiliar challenges as well as some productive outcomes.

The wiki was used as a teaching and learning tool which could potentially implement and embrace some of the core ideas of social constructivism. In general, the social constructivist epistemological stance embraces the notion that knowledge is constructed within social contexts (Tobin, 1993). The social constructivist is "concerned with such matters as negotiation, cooperation, conflict, rhetoric, ritual, roles, social scenarios" (Gergen, 1995, p. 25) because these provide occasion for construction of knowledge. Ernest (1996) describes the underlying metaphor as "that of persons in conversation, comprising persons in meaningful linguistic and extralinguistic interaction and dialogue" (p. 342). There is much promise for wikis as environments for the co-construction of knowledge; they have the potential to provide a virtual space for learning as conceptualized within the social constructivist epistemological framework. Indeed, Parker and Chao (2007) described wikis as a success story within the world of social constructivism because of their ability to facilitate collaborative, community-based knowledge building.

This appeal of wikis as instructional tools is, however, accompanied by a suite of choices about how to implement and integrate a wiki into a course. Indeed, in the courses discussed herein, the decisions that the instructor made about the design/structure of the wiki and the students' wiki-based tasks were deterministic factors in the evolution of the wiki. The utility of the wiki as a

knowledge repository may have been undermined by organizational decisions (e.g., page names and section headings) and by the nature and design of the students' wiki-based tasks. This paper reports on two instances of wiki usage in two different but related courses; it is an exploration of the roles which the wiki structure and the design of tasks played in the development of the wiki, and an investigation of the students' perceptions of the role of the wiki structure in the collaborative construction of one of these wikis.

## Wiki-Based Courses

The focus of the initial course was the teaching and learning of probability and statistics at the K-12 level; it will hereafter be referred to as "the statistics course". There were 13 students in the class, all of whom had secondary mathematics teaching credentials and most were concurrently teaching secondary mathematics. All of them were working toward a Master of Science in Mathematics with a focus in secondary education; this program requires students to take comprehensive exams, one of which may, if the student chooses, be based on the content of the statistics course. The course met once per week in the evening. Each week, students were assigned pedagogic-focused reading in addition to more content-focused assignments which included additional readings about the relevant content area (i.e., a probability/statistics topic) and homework problems intended to encourage deeper thinking about probability and statistics.

The following semester, the instructor taught a similar course to a similar audience of students. This second course was concerned with the teaching and learning of algebra and will herein be referred to as "the algebra course". Out of the 20 students enrolled in this course, seven had taken the statistics course in the prior semester. The description of the structure of the statistics course in the preceding paragraph also applies to the algebra course; that is, weekly assignments followed the same pattern. Relevant differences between the courses will be discussed throughout this paper. The wiki was used for multiple purposes in both courses:

1. *For dissemination of course information*. The syllabus and homework assignments were posted to the wiki.
2. *As an assessment tool.* Students were required to make weekly contributions to the wiki. This activity served as an alternative to weekly reflection papers about the course readings and was called "Glean & Record"; it will be discussed in further detail below.
3. *As a knowledge repository.* The weekly goal was for students, as a result of the Glean & Record task, to collaboratively produce summaries of useful information from the weekly readings. This was intended to aid students in the completion of a final project and in studying for the comprehensive examination.
4. *As a continuing source of useful material for secondary teachers.* Students were required to contribute to useful teacher-oriented probability and statistics links to a wiki page called "Resources". Students contributed lesson plans to a wiki page called "Lesson Plans." Students recorded encounters with probability and statistics ideas in the media on a page called "Encounters." Interesting problems with the potential for use in secondary classrooms were posted to the "Probability & Statistics Problems" page in the statistics course. The instructor's goal was that these pages would be useful for the secondary teachers even after the conclusion of the course.
5. *As a tool for collaboration.* Discussion boards were available for discussing homework problems. The Consolidation Task (described below) required collaborative work.
6. *As a forum for discussion.* Students were encouraged to post opinions about course readings on the discussion boards. A goal was that, for a course that met only once per week, this would encourage engagement throughout the week.

This paper is about specific themes that emerged within the context of these goals and which are supported by data that were gathered from the wiki in both courses and from survey data in the statistics course. In particular, the focus is on the importance of the structure of the wiki and of thoughtful task design in facilitating or hindering these goals.

## Wiki Design and Two Related Tasks

Two guiding questions in the design of the first wiki (for the statistics course) were "What would be useful to secondary mathematics teachers?" and "What are important themes in this class?" Before the class began, the instructor created pages that reflected themes that cut across all of the readings in the course. These themes were "[K-12] Student Thinking," "Implications for Teaching," and "Probability & Statistics Problems." Each week, as part of the Glean & Record task, students were required to contribute to one these three pages; that is, they were to glean information from the reading which either (1) pertained to K-12 student thinking about probability and statistics, (2) had implications for teaching these subjects, or (3) presented interesting problems which could be used in their classrooms. They were then required to record these findings on the relevant wiki page. The first iteration of this task, in the statistics course, was defined as such:

**Glean and record**. Your task (as a class) is to glean useful information from the assigned articles and to record it on one of the following wiki pages: "Student Thinking," "Implications for Teaching," or "Probability & Statistics Problems". I have created headings for you to work around on some of these pages (you can change them if you see fit). What counts as "useful?" You get to decide... but it should be useful to you as teachers and as learners. Create new content, build off of existing content, add sections, fix others' typos and grammatical errors, explain useful definitions and give examples, record good problems/examples... all of these are acceptable. Cite the source you're drawing from in APA style like "(Shaugnessy, 2006)" and add the source to the references page if it's not already there. Whatever you contribute should be complete enough that it would be useful to you if you were come to back and read it in a year. BE SURE TO maintain a nice structure on the page... this is our wiki, it should be useful and usable. I expect you to make at least two distinct contributions to the above pages. Beyond this requirement, contribute as much as you want.

The headings which the instructor added to the pages reflected broad themes which were relevant to multiple classes and readings; for example, on the Student Thinking page, the headings "[K-12] Student Thinking about Center" and "[K-12] Student Thinking about Variability" were added. As the semester continued, the students were largely responsible for creating additional section headings and for organizing the newly-created wiki content. Much of the first class session was devoted to training on the use of the wiki. All but one of the 13 students had never contributed to a wiki before.

During both the statistics and algebra courses, Glean & Record was repeated weekly. In the statistics course, this task underwent an evolution in response to weekly outcomes. The first change was to clearly specify that reflections and opinions about the readings belonged on the discussion boards; the "Student Thinking," "Implications for Teaching," and "Probability & Statistics Problems" pages were to be used to record details and facts from the reading. In response to issues with clutter and repetition, a second change lowered the requirement from two to one wiki contribution per week. In general, grades for this task were based solely on completion. On a few occasions where a student's wiki contribution was erroneous, vague, or clearly redundant, her/his grade was lowered.

In the statistics course, some organizational and quality issues developed on the "[K-12] Student Thinking" and "Implications for Teaching" pages. Some section headings and entries were

redundant both within and across the two pages and formatting was inconsistent (e.g., differences in text styles). Furthermore, there were some entries which did not meet the standard of quality as specified in the task description; that is, many contributions were not detailed enough that, if one were to reread them one year later, they would be intelligible and useful. In response to this, the instructor assigned a collaborative activity to encourage consolidation and organization of the Glean & Record material both on the wiki and, potentially, in the minds of students. In order to further demonstrate what constituted desirable formatting, the instructor did a small amount of organizing on the "Implications for Teaching" page. The description of the Consolidation Task in the statistics course follows:

Look at the format of the "Implications for Teaching Page" on the course wiki. It has become a bit disorganized/cluttered lately but here are some things to notice:

- Headings are mostly consistent.
- Horizontal lines separate sections.
- There is a menu at the beginning of the page.

These are desirable features.

However, all the wiki pages suffer from a bit of disorganization and redundancy.

You will be assigned to a group. Your group will have the task of organizing some wiki page(s) and removing the redundant entries. You will need to incorporate the "desirable features" listed above. Please clean up the grammar, spelling, formatting, etc. If you need to move something to another group's wiki page then you will need to coordinate with them. We will devote some in-class time to this.

The following pages will be assigned:

- Implications for Teaching
- Student Thinking
- Prob & Stat Problems
- Probability

The point of this task is to help you consolidate some of what you've learned this semester. It will also help turn the wiki into a more useful tool for your final project, as you study for the comprehensive exam, and as you incorporate this information into your classrooms.

Much of the motivation for the Consolidation Task was to rectify the disorganization which resulted from the Glean & Record task. Below, it is argued that the disorganization was, in part, caused by some structural elements which had been imposed on the wiki (e.g., pre-designated headings). Survey data from the statistics class reveals that this analysis aligns with students' perceptions of the course. Also included is a description of an alternative wiki design used in the algebra course.

## Literature Review

Despite the recent invention of wikis, many have noted how, if used wisely, wikis can be effective collaborative learning tools (e.g., Boulos, Maramba, & Wheeler, 2006; Evans, 2006; Holtman, 2009; Larusson & Alterman, 2009; Tetard, Patokorpi, & Packalen, 2009). Though there are some specific recommendations about how to use the wiki "wisely", these are often associated with specific contexts. This context-based specificity of wiki design advice stands in contrast to general website design principles as wiki services typically pre-empt many broad website design decisions. Indeed, in the statistics and algebra courses, the instructor had control

of only some, but not all, elements of what Garrett (2002) called the structure, skeleton, and surface of the site.

Of greater relevance to framing the present study are reports which specifically address the choices which instructors can make when structuring a wiki for classroom use (e.g., the site pages and page headings) and how these choices may support academic tasks. A review of literature on wiki usage in educational settings reveals that the context and goals for wiki use will largely dictate the parameters of a successful implementation. Of particular interest are reports on wikis implemented as collaboratively-created knowledge repositories in educational settings, especially those reports which describe the structure of wiki-based tasks and the corresponding wiki design. For example, Guzdial, Rick, and Kehoe (2001) used CoWeb, a wiki tool, in a variety of graduate and undergraduate courses for distributing information, collaborative document creation, and discussion/review activities; across their implementations, they noted that "all the successful uses involved some small, required activity, and then some interesting activities that engendered students' interest" (p. 277).

Ren, Baker, and Zhang (2009) and Evans (2006) described the collaborative creation of wiki-based textbooks in semester-long courses at the undergraduate and graduate levels, respectively. In the task described by Ren et al., the instructor had pre-determined the structure of the wiki-based textbook (the topics/articles and chapters). Furthermore, a system was developed in which three versions of each chapter would be authored and then voted upon by students. Each article was initially written by an individual student followed by cycles of feedback and revision. Guzdial, Rick, and Kehoe (2001) similarly reported that, within their collaborative writing tasks, a teaching assistant had created a page for each topic which the class addressed. Thus, Ren et al. and Guzdial et al. described a wiki design paradigm actively guided by the instructors and based on specific themes and topics.

Larusson and Alterman (2009) describe two case studies of wiki use (in technology-oriented undergraduate courses) which support their claim that, "for a particular learning activity, the preformatted organization of the wiki has a dual function. It supports coordination and scaffolds the learning activity" (p. 378). They also described the challenges of finding common ground on a wiki which resulted largely from the asynchronous nature of wiki usage. They noted that the predetermined structure (e.g., pages, headings) and materials (e.g., prototypes, checklists) on the wiki can guide students' design work and interactions.

Tetard, Patokorpi, and Packalen (2009) also designed their wiki-based tasks to include suggestions to students on how to organize their work on the wiki, although the extent to which students followed this structure and its influence on the outcomes are unclear from their report. Stahl, Wee, and Looi (2007) used a wiki as a knowledge repository in coordination with a larger virtual environment for mathematics; they reported on the importance of "seeding" a wiki so that it can support "a rich but focused knowledge-building experience" (p. 5). Furthermore, they emphasized the necessity to design curricular materials and choose technology so that they may be mutually supportive. In summary, these reports describe wiki implementations in which the wiki structure is constantly monitored by the instructors and coordinated with course tasks.

## Methods

The present study was guided by the Design-Based Research paradigm (Design-Based Research Collective, 2003), an "emerging paradigm for the study of learning in context through the systematic design and study of instructional strategies and tools" (p. 5). Research of this type is often cyclical with multiple iterations of design, implementation, and analysis within an authentic educational setting. A goal, within this research paradigm, is the production of sharable theories that are relevant to users of these instructional tools and that may help advance and consolidate

design knowledge. The qualitative study presented herein examines design elements of wikis and wiki-based tasks in two graduate mathematics education courses.

As objects of research, wikis have some particularly nice features related to data collection. The history of all updates to the wiki and general usage statistics (e.g., unique visitors, views) were incorporated into the wiki service used in both courses. As a participant-observer, the author kept a journal about the experience of teaching with a wiki. The primary source of data for analyzing student perceptions of the wiki was an end of semester survey given in only the statistics course. The survey consisted of six five-level Likert items followed by five open response questions. All 13 students completed the survey.

On each of the first six items, respondents chose from among the following ratings: Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly Agree. These items were:

1. I will continue to contribute to the course wiki after this course is completed.
2. I will use the course wiki as a reference after this course is completed.
3. I will use a wiki as part of a course I teach.
4. The wiki was useful in this class as a tool for collaboration.
5. The wiki was useful in this class as a repository for knowledge.
6. The wiki was useful in this class as a reference tool.

The following five questions were open response. They were:

1. What was your overall impression of the wiki we used in this course?
2. In what ways was the wiki beneficial in this course?
3. What challenges were associated with using the wiki in this course?
4. What changes could be made to the course to make the wiki a more useful tool?
5. What other comments do you have about the use of wikis in general?

Survey data were recorded in a spreadsheet. Responses to questions 7 through 11 were coded according to the themes which emerged in the data. The process of coding and unitizing the survey data was iterative and cyclic. Herein, consideration is given to survey responses which are relevant to an examination of wiki design and student tasks.

The present focus is primarily on the results of the cycle of wiki design, implementation, and analysis which played out within the context of a graduate mathematics education course on the teaching and learning of probability and statistics, referred to throughout as “the statistics course”. However, the results of this cycle are put in relief by the redesign and implementation of the wiki and wiki-based tasks for the algebra course taught in the following semester. These two iterations of wiki usage are the formative core of the results and discussion.

## Results

In the statistics course, the intended outcome for the Glean & Record tasks was an organized reference tool about the course readings. As noted above, the instructor imposed a structure on this task by organizing the wiki thematically; students were encouraged to find information relevant to “[K-12] student learning” or which had “implications for teaching” and to organize this information on corresponding wiki pages. As the semester progressed, there was a general recognition by the instructor and students that the wiki was becoming disorganized and that many contributions were redundant.

The obstacle imposed by the structure of the wiki was evident in the survey results. Of the 13 students, eight specifically mentioned the organization of the wiki as an obstacle or as something to be improved. For example, one student noted that the wiki was "a bit disorganized and foreign, but after the final fix up it looks better" (Student #2); the "final fix up" was the Consolidation Task. Another student (#1) expressed a similar sentiment: "At the beginning it was not organized but as the course continued, in my opinion, it got better and it became very useful." Student #9 noted that, "it was confusing to know what information to put on certain pages." Other students suggested possible ways to improve the structure of the wiki:

- "I would create a pre-existing infrastructure to provide more direction for contributions and allow for immediate organization and usefulness." (#3)
- "Have more guiding questions for certain pages so students have a better understanding of what they need to post on the wiki." (#6)
- "Maybe the skeleton (format) of the pages can be established when the course begins." (#7)

Despite these comments students were generally in agreement with item 5 on the survey: The wiki was useful in this class as a repository for knowledge. Four students strongly agreed with that statement, five agreed, and the remaining four neither agreed nor disagreed.

The results of the Consolidation Task give an additional indication of the disorder that resulted from the Glean & Record task within the framework of the wiki design. It should first be noted that the breadth and depth of content on the two main pages, "Implications for Teaching" and "[K-12] Student Thinking", did not change significantly as a result of the Consolidation Task. Though an imperfect metric, word counts on each of the pages before and after reorganization revealed a reduction in wordiness. The Student Thinking page was reduced from 7269 to 3175 words. The Implications for Teaching page was reduced from 6991 to 5660 words; it is possible that this change was less dramatic because the instructor completed some organizational work on this page before assigning the Consolidation Task.

Also of interest are the organizational strategies employed by the student groups on these two pages. Both pages had previously been organized thematically. For example, the Implications for Teaching page had headings such as "The Role of Language" and "Building on Students' Intuitive Notions." After the Consolidation Task, the Implications for Teaching page was organized chronologically; level 1 headings were of the form "Week #" and level 2 headings were the names of the readings. The "[K-12] Student Thinking" page continued to be organized thematically with level 1 section headings of the form "Student Thinking about [Prob/Stat Topic]".

## Discussion

As part of a graduate mathematics education course in statistics, wiki-based tasks were assigned in order to document and synthesize the material covered in the course readings. The goal was for the wiki to be of use for the completion of future course assignments (the final project, which was not fully discussed, required students to reference course readings), for future studies (e.g., preparation for comprehensive exams), and as a resource for the students (who were secondary mathematics teachers) in their own classrooms. The Glean & Record task was executed within a structure that the instructor had partially imposed. He had created the "Implications for Teaching" and "[K-12] Student Thinking" pages as thematic organizers for the readings. Within these pages the structure was largely created by the students. The result was redundancy within and between the two pages.

Despite this flawed implementation, wikis have significant promise as teaching tools. Parker & Chao (2007) noted that wikis are most commonly used in supporting writing instruction. However, the goals which the instructor set for the two course wikis were more closely aligned with the authoring of a wiki textbook as done, for example, by Richard Watson, a business school professor, and as described by Evans (2006). Watson's advice for the instructor to "take the role of designer, rather than professor" was at least partially applicable in both the statistics and algebra courses. The architecture of the wiki (its pages, headings, and sections) combined with the design of the Glean & Record task did not result in a streamlined, organized knowledge repository. However, the flexibility of the wiki supported a tractable remedy; at the conclusion of the Consolidation Task, the wiki no longer suffered from these obstacles to its utility.

Beyond its role as an organizational remedy, the Consolidation Task may stand on its own merits. As one of the final projects for the course, it was an effective tool for forcing students to revisit course material with a "big picture" perspective that the students developed throughout the semester. It may share some positive pedagogical features with more traditional end-of-course assignments such as requiring students to incorporate the course readings into a final paper or to reference them as part of a formal examination.

There were two organizational paradigms that resulted from the Consolidation task: thematic and chronological. These constituted revisions to the a priori thematic organizational paradigm which the instructor had imposed on the statistics course wiki as a framework for the weekly Glean & Record Tasks. However, in the class' collective attempt to use the wiki as a knowledge repository, the initial choice of a thematic paradigm had a palpable impact. Students described the initial structure of the wiki as problematic and offered suggestions for fixing it.

The following semester, the instructor used a wiki and the Glean and Record task in the algebra course. In this course, he organized the wiki chronologically. There was a single wiki page called "Readings" with level one headings of the form "Round #" and level two headings with the titles of articles assigned for reading. This wiki suffered from very little redundancy. As one of their final projects, the students were assigned an updated Consolidation Task for which the instructor chose a handful of themes which cut across the semester's readings. For each theme a group was to be tasked with designing a wiki page which organized information from the Weekly Readings page pertinent to that theme. Unfortunately, due to time restrictions and computer lab availability, the task was canceled; although, the instructor plans on integrating it into a future course.

On this second attempt at using a wiki as a teaching tool, many of the organizational caveats were avoided. Certainly the choice of tasks and the chronological organization played a role in this. However, with seven out of 20 students in the second course having had wiki experience, there may be some limitations on the comparability of the two courses. Furthermore, a change to grading policies for wiki contributions may have also had an impact on the outcomes. Specifically, in the algebra course, students were required to contribute for a minimum number of weeks rather than each week. The intention was that this policy would reduce the number of redundant or less thoughtful wiki contributions which may have been made simply for the purposes of fulfilling a requirement.

## Conclusions

It has been suggested that, when using a wiki as a collaboratively developed classroom knowledge repository, design decisions, wiki-based tasks, and assessment strategies have an impact on the quality of the resulting wiki. This claim is certainly aligned with the descriptions of wiki implementations by Larusson and Alterman (2009) and Stahl, Wee, and Looi (2007) which made use of what they described as "preformatted organization" and "seeding", respectively. However, a literature review also revealed descriptions of wiki implementations which were arranged thematically (e.g., Guzdial, Rick, and Kehoe, 2001; Ren, Baker, and Zhang, 2009). The author has suggested two paradigms for organizing the content of a wiki used for this purpose, chronological and thematic (this is not intended as an exhaustive list). The choice of wiki architecture must be made in concert with a careful design of wiki-based tasks and their assessment strategies.

Within the context of two graduate level mathematics education courses, the chronological paradigm worked better with the Glean & Record task in the sense that the results were more organized and less prone to redundant contributions. Furthermore, this initial design paradigm can support an end-of-course collaborative activity which results in a wiki reorganization according to a thematic paradigm. Such an activity would take advantage of the students' semester-long growth in perspectives, could support learning, and could produce a valuable reference tool.

Wiki creation as a class activity is appealing and provocative. It has the potential to embody many constructivist learning principles and may result in a broadly useful and evolving tool for those who contribute to (or merely read) the wiki. But wiki-based tasks may be supported or undermined by the design of the wiki; in other words, the choices of site structure, page names, and section headings are impactful. A continued discussion of design principles, effective tasks, and assessment strategies would be useful for instructors who are excited by the possibilities of this relatively new technology.

## References

Boulos, M. N. K., Maramba, I., & Wheeler, S. (2006). Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. *BMC medical education*, *6*(1), 41.

Design-Based Research Collective. (2003). Design-Based Research: An Emerging Paradigm for Educational Inquiry. *Educational Researcher*, *32*(1), 5-8.

Ernest, P. (1996). Varieties of constructivism: A framework for comparison. *Theories of mathematical learning*, 335–350.

Evans, P. (2006). The wiki factor. *BizEd*, *5*(2), 28–32.

Garrett, J. J. (2002). *The Elements of User Experience: User-Centered Design for the Web*. Peachpit Press.

Gergen, K. J. (1995). Social construction and the educational process. *Constructivism in education*, 17–39.

Guzdial, M., Rick, J., & Kehoe, C. (2001). Beyond adoption to invention: Teacher-created collaborative activities in higher education. *Journal of the Learning Sciences*, *10*(3), 265–279.

Holtman, L. (2009). Using Wikis in the Teaching of a Short Course on the History and Philosophy of Science. *Instructional Technology*, 29.

Larusson, J. A., & Alterman, R. (2009). Wikis to support the "collaborative" part of collaborative learning. *International Journal of Computer-Supported Collaborative Learning*, *4*(4), 371–402.

Parker, K. R., & Chao, J. T. (2007). Wiki as a teaching tool. *Interdisciplinary Journal of Knowledge and Learning Objects*, *3*, 57–72.

Ren, Z., Baker, P., & Zhang, S. (2009). Effects of Student-Written Wiki-Based Textbooks on Pre-Service Teachers' Epistemological Beliefs. *Journal of Educational Computing Research*, *40*(4), 429–449.

Stahl, G., Wee, J. D., & Looi, C. K. (2007). Using chat, whiteboard and wiki to support knowledge building. *International Conference on Computers in Education (ICCE 07), Hiroshima, Japan. Retrieved from http://GerryStahl. net/pub/icce07. pdf*.

Tetard, F., Patokorpi, E., & Packalen, K. (2009). Using Wikis to support constructivist learning: a case study in university education settings. *System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference on* (p. 1–10).

Tobin, K. G. (1993). *The practice of constructivism in science education*. Lawrence Erlbaum.

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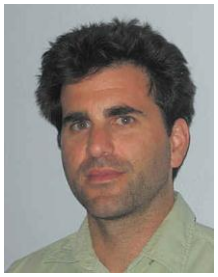

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**Editor's Note**: Computer Mediated Communications (CMC) is increasing used for writing development and for language teaching and learning. This intensive study with a small pilot group of students provides useful insights for design of future studies.

# Electronic Dialog Journal Writing and its Effect on High School Student's Writing Improvement

**Maliheh Rizaei**
**Iran**

## Abstract

Electronic Dialogue Journal Writing as a form of free writing practice in a Computer-Mediated Communication (CMC) context provides students with the opportunity to reflect on their interests and writing about them to a native speaker partner, thus, receive authentic language input which develops their literacy skills. Despite their remarkable potentials, Electronic Dialog Journal Writing (E-DJW) practices have been rare in some contexts at school-level. In an attempt to bridge this gap, the present study set out to address the impact of E-DJW on high school students' writing development. In so doing, four groups, each containing an English native speaker student and a non-native speaker student were engaged in an E-DJW project over a twelve-week period. The findings of the study revealed that the non-native speaker students' writings improved in different aspects of writing, principally in terms of 'content'. This study provides useful insights for writing instruction and raises both students' and teachers' awareness of E-DJW as a writing activity that provides students with an encouraging environment which fosters learning and achievement.

**Keywords**: Email Dialogue Journal Writing (E-DJW), Computer-Mediated Communication (CMC), Sociocultural Theory (SCT), writing improvement, native speaker (NS), non-native speaker (NNS)

## Introduction

With the breakout of Information Communication Technology, Computer Mediated Communication (CMC) has gained increasing momentum during the last decades. Language educators have also started to explore the potential of CMC for language teaching and learning. CMC is integrated in the classroom along two paths; some educators use synchronous (SCMC) software programs such as, real-time chats while others use asynchronous (ACMC) modes particularly email to set up long-distance exchanges. Of all CMC mediums, email is now the most common tool for interaction between students and their pals or instructors. As compared with non-native speakers, the issue of email communication is more complicated for second language learners but integrating such skills is essential in societies like Iran which are increasingly becoming information driven. Despite its potential benefits, CMC is still viewed as a new medium for communication in Iran particularly at school levels.

In the Iranian educational context, students are not interested and not motivated to write; they write only when they are asked to. Specifically high school students' writing is poor in different aspects of content, organization and vocabularies although they are taught how to generate well-developed writings. One of the main reasons for their weakness is that they lack enough practice of writing which consequently hinders their progress in writing skill. Another reason lies in the fact that unlike ESL students in English-speaking countries, EFL learners in Iran lack exposure to English outside the classroom. Similarly, writing practices in EFL contexts have consistently posed major challenges to both educators and learners due to their de-contextualized nature which portraits an aimless and unrewarding view of writing (Faigly, Daly & Witte, 1981). As a result,

foreign language educators have long been faced with the dilemma of what writing activities to incorporate into their courses to enhance students' written competence.

Recently, however, there has been a shift towards more free writing activities such as dialogue journal writing (DJW) which is a more holistic and flexible writing practice and introducing it in EFL writing pedagogy creates both theoretical and practical practices. Mirhosseini (2009) believes that "DJW, as a flexible and potentially rich educational practice, can be employed for teaching at almost all EFL proficiency levels and in almost all educational contexts" (pp. 42-43). It provides the students with the opportunity to use English in a non-threatening atmosphere, interact with a proficient English speaker, use reading and writing in purposeful ways and provides a natural, comfortable bridge to other kinds of writing that are done in school (Peyton, 1987). On the other hand, it is expected that CMC, specifically email, acts both as a stimulating tool which encourages student writers to write and a convenient medium for instructors or more proficient peers who want to provide feedback to student writers. Through email, the interaction between students and instructors or peers is not limited to the classroom; this, in turn, positively influences students' writing progress. As such, Email Dialogue Journal Writing (E-DJW) is integrated in this study because it contributes to a purposeful use of writing and helps students improve their writing skill by providing them with a non-threatening and motivating learning context.

## Theoretical Framework

Sociocultural Theory (SCT) put emphasis on the assumption that development occurs as the result of meaningful interaction between novices and more knowledgeable interlocutors such as parents, peers, or teachers (Vygotsky, 1978). Vygotsky contended that “learners benefit most from social interactions concerning tasks that they cannot do alone but can do in collaboration with more knowledgeable or more experienced individuals” (1978, p. 86). Besides teacher contribution, this definition acknowledges the benefits of peer interaction for L2 development (Donato, 1994) which is the focus of the present study.

Process approach to writing also supports the interaction between less knowledgeable writers with their teacher or other peers as a useful technique for learning. DJW is an approach which encourages collaborative learning in writing classes. Dialogue journals are defined as "written conversations in which a learner and teacher or other writing partners communicate daily, weekly or on a schedule that fits the educational setting over a semester, school year or course" (Razak & Asmawi, 2004, p. 19). So, students are not restricted by teacher or curriculum-established topics or genres that must be covered in sequence. They can write on important topics happen to them in their daily lives (Peyton, 1987). During the DJW process, teachers or more capable peers regularly comment on different aspects of a learner's writing, responding or posing questions and might introduce their own dialogue topics. Thus, DJW "supports the writing process by providing an authentic two-way written interaction between writing partners" (Liao & Wong, 2010, pp. 141-142). In DJW, as emphasized by SCT, the process of interaction between two or more participants allows the negotiation and communication of meaning through written messages so the two parties construct knowledge together. The other benefits of DJW reported by many researchers in the field include development of accuracy and linguistic competence (Pi, 2002), development of writing fluency (Holmes & Moulton, 1997), reduction of writing apprehension (Liao & Wong, 2010), language function development (Nassaji & Cumming, 2000), and increase in students' motivation (Liao & Wong, 2010; Lucas, 1990).

## Email Dialogue Journal Writing

SCT centers on the notion of social activity which has now expanded to not only classroom interactions, but also Computer-Mediated Communication (CMC) context (Warschauer, 1995,

1997). Barnard and Campbell (2005) state that in writing classrooms, writing process "is mediated both by the available cultural tools such as pen and paper and electronic media" (p. 89). Thus computers can be used to scaffold writing development by writing easier, writing more, writing differently, and writing better (Pennington, 1996). Due to the growing use of computer technology, students may prefer to record their insights or reflections in some electronic form. Of the electronic media, e-mail makes writing a purposeful learning experience and offers better opportunities for interaction and enhances one's writing skills (Razak & Asmawi, 2004). It specifically makes it possible to write communicatively and collaboratively with a native speaker so the language input received is authentic. The adaptability of DJW for computer-assisted educational practices, has led to a new form of DJW, i.e., Email Dialogue Journal Writing (E-DJW).

Most of the studies done on DJW have been based on the interaction between students and their teacher and have not been conducted within CMC context (Holmes & Moulton, 1997; Nassaji & Cumming, 2000; Peyton, 1987). Yet, a few studies have addressed the effect of email dialogue journals between peers on students' writing improvement. Stapa and Al-Bakri (2001) conducted a study to four male and female Malaysian university students to see the effectiveness of email in DJW. The findings of the study revealed an all around improvement in content, language and vocabulary of the students' writings. In her study, Wang (1994) observed the additional advantages of E-DJW over the traditional DJW. Findings of this her study showed that the ESL students in the E-DJW group asked more questions, used more language functions and adapted more conversational tone in their language than did the traditional group.

Another group of studies have specifically been involved in exchanges between L2 learners and native speakers of the given language which is addressed in the present study. Conducting a study on E-DJW on her Spanish students, Gonzales-Bueno (1998) found that students used E-DJW as a tool to practice English language and communicate without the fear of making mistakes since mistakes were tolerated and emphasis was on content and development of ideas than linguistic form. This experience improved the overall quality of the students' writing. Pi (2002) examined the effect of email interaction on students' English DJW. The interaction of three Taiwanese elementary students with native English speakers in America revealed a great development in syntactic and lexical complexity and sentence length in students' writing. To examine the effect of email interaction on students' dialogue journal English writing, Lin and Yang (2010) administered a study between two non-English major students and one native English speaker. The findings of their study showed that the two non-native students asked the native speaker more genuine questions and benefited the activity in terms of experiencing the cultural differences, having more writing practices, learning new words and writing communicatively with a foreigner.

## Objectives of the Study

The studies reviewed above highlight the significance of E-DJW in generating a positive learning experience which leads to writing improvement in different aspects of writing. However, few studies on DJW are done within CMC contexts and little attention is given to the effect of E-DJW on EFL high school students' writing improvement. Also, few studies have set up exchanges between non-native student writers and native speaker pals. These shortcomings avoid the generalization of their findings to other contexts. So, the present study intends to employ E-DJW as a holistic and practical approach to investigate improvements that may occur in the Iranian educational context. In particular, this study is set out to see the effect of E-DJW on high school students' writing improvement. To promote authentic usage of language and generating a non-threatening atmosphere, the written journal communication is done between two groups of peers who are non-native as well as native speakers of English.

## Methodology

### *Participants*

In this study, the participants were eight female high school students. They volunteered to take part in the study since they had experience of communicating with email, thus, using email did not pose any problem for them. Of the eight participants, four students were non-native speakers of English (Native speakers of Farsi) (NNS), studying at a bilingual school in Shiraz, Iran and four students were Iranian but native speakers (NS) of English studying at a high school in Canada. The purpose for choosing these native students was that, though grown up in Canada, they had studied in the same bilingual school that the NNS students studied for a few years and had a close relationship with them, thus, both parties were willing to communicate with each other. The participants' willingness to participate was particularly important since it ensured their commitment to the experiment under investigation. As for the proficiency level, the NNS participants were at intermediate level. For the purpose of the study the eight participants formed four pairs each containing a NNS and a NS student (Table 1).

**Table 1**
**Profile of the participants**

| | NNS students | NS students |
|---|---|---|
| **Pair 1** | Asma | Sara |
| **Pair 2** | Shadi | Mana |
| **Pair 3** | Neda | Fariba |
| **Pair 4** | Sonia | Lina |

### *Data collection procedure*

Before the E-DJW project began, an informal session was held between the teacher and the NNS students in which the NNS students were explained and briefed about the concept of E-DJW and what they were expected to do throughout the experimental period. The turn-taking E-DJW sessions continued for twelve weeks. The students were supposed to write at least twice a week to their e-pals. As E-DJW is a free-writing activity, the students were allowed to write on self-generated topics of interest. They were also informed that the focus would rather be on the fluency than accuracy. Once the NNS students started writing to their NS e-pals, they were asked to email the messages not only to their e-pals but also to the researcher. So, she could keep track of the messages and save them for future analysis and retrieval. During the experimental period a total of 94 messages were collected.

### *Data analysis*

The data collected were analyzed by two raters using an adapted Scoring Rubric developed by Ferris and Hedgcock (1998) (see Appendix A) which allowed examination of writings at three important levels of writing qualities, namely, content, organization and vocabulary. Each aspect is scored across eight band scores of Excellent (7-8), Good (5-6), Fair (3-4), and Poor (1-2); therefore, the total score for each journal entry is 24 points. Two independent raters skillful in utilizing this scoring rubric scored 8 papers. The inter-rater reliability was 0.95. The two raters were further discussed to standardize their scoring. The raw scores were then subjected to descriptive statistics so the mean for different aspects of the dialogue journal entries showed the degree to which the NNS students' writings had improved in different aspects of writing.

## Results and Discussion

Table 2 shows the raw scores of the NNS students' dialogue journal entries.

**Table 2**
**The NNS students' raw scores of the dialogue journals**

| Weeks | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Journal entries | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Asma | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 10 | 10 | 10 | 12 | 11 | 12 | 13 | 14 | 14 | 16 | 17 | 17 | 18 | 18 | 19 | 20 | 21 |
| Shadi | 5 | 5 | 6 | 6 | 7 | 7 | 9 | | 8 | 9 | 10 | 10 | 11 | 12 | 12 | 14 | 13 | 14 | 14 | 15 | 16 | 16 | 16 | 17 |
| Paria | 7 | 6 | 7 | 7 | 7 | 8 | 8 | 9 | 9 | 9 | 12 | 10 | 11 | 12 | 13 | 13 | 11 | 10 | 13 | 14 | | 14 | 15 | 15 |
| Sonia | 7 | 5 | 7 | 6 | 7 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 11 | 12 | 12 | 14 | 13 | 14 | 16 | 16 | 17 | 19 | 20 |

Table 2 demonstrates the students' commitment to the E-DJW project in that, the NNS students wrote to their e-pals twice a week with the exception of Shadi and Paria who wrote only once to their e-pals on weeks 4 and 10, respectively. More significantly, it was found that the scores increased gradually from the initial to the final dialogue journal entries for all the NNS students, with Asma improved more than the three other students. The mean of the journal entries regarding the three aspects of writing, i.e., content, organization and vocabulary is presented in Table 3.

**Table 3**
**Mean for the aspects of writing**

| | Mean/% | | |
|---|---|---|---|
| **Participants** | **Content** | **Organization** | **Vocabulary** |
| **Asma** | 49 | 20 | 31 |
| **Shadi** | 46 | 25 | 29 |
| **Paria** | 47 | 21 | 32 |
| **Sonia** | 48 | 31 | 21 |

The data presented in Table 3 shows that among the three aspects of writing, the NNS students developed the most in 'content', followed by 'vocabulary'. Nearly half of the NNS students' writing improvement was associated with the category of 'content'(Asma: 49%, shadi: 46%, Paria: 47%, Sonia: 48%). DJW is a free writing activity, thus, the NNS students were emphasized not to focus on form. It is argued that lack of overt error correction is an essential characteristic of DJW (Peyton, 1987; Gonzales-Bueno, 1998). As it is suggested by the results, when focus on form reduced, an additional effort was made to enrich the content and development of the ideas. So, a lot of topic extension was observed between the two parties in the dialogue journal entries. Table 3 also shows that vocabulary is the second aspect of writing developed during the DJW practices. All the NNS students revealed a sufficient range of vocabulary (Asma: 31%, shadi: 29%, Paria: 32%, Sonia: 21%) which was gradually developed as they wrote more on their topics of interest. All the NNS students grasped the words they encountered in their NS partners' writings and tried to use them in their subsequent writings. 'Organization' was the least developed aspect of writing in the NNS students' dialogue entries (Asma: 20%, shadi: 25%, Paria: 21%, Sonia: 31%). Sonia was the only student whose improvement in category of 'organization' (31%) was higher than that of the category of 'vocabulary' (21%). The 'organization' aspect of the NNS students did not develop as much as the other aspects of writing, in other words, they did not provide the information in an orderly manner and the flow of writing was not logical and straightforward.

To illustrate the above discussion, samples of Paria's first and final dialogue journal entries are presented as following.

### *Paria's first journal entry*

hi how r u? Yes your right sometimes we need to talk to someone that have good experience cause it can help us in our life.

About the parents that didn't look over their kids (or our parents that didn't pay attention to us) I think we were so impolite and some impolite things and when we get older we can't find good friends in school even university and we can't pass successful our studies, we can't find a good job plus that boy or girl it's gone go into a very bad way and get friend with some spotty people.

I'm so glad that we have good friends and nice parent's.

Now if your best friend (that you love her too much) tell you some thing that broke your heart what do you do? What is your reaction?

Content: 3 Organization: 2 Vocabulary: 2

### *Paria's final journal entry*

Yeah the reason i wasn't able to check my email was that we were changing our internet the speed is X10 more but then the man who came to fix it for us typed a part of our address wrong purposely so we ask him to come again and fix it for us, this way he was get paid twice. I don't understand why people do all these nasty things just to get a couple extra money, and it's not even Halal so something bad's gonna happen to them 'lol'

Back to the subject. They say next year's gonna be really hard mostly since we're studying our 12th grade Physics. I'm taking math&physics, Karate (the usual), and Gym to workout. i also treid to find a private french teacher since classes at Kanun have already started and they dont sign me up. But Havent' found a teacher yet. My Karate class is on saturdays, mondays and wednesdays. On Sundays and thursdays i have physics&math from morning till noon (at my school). On fridays I'm not busy… it's pretty sweeeet….

But you sound really busy; take it easy. It's marvelous that you record your voice for the elementry kids. Good job, you'r getting popular. what stuff do you say? is it in Persian or English? ... or both? Is it acceptable to the kids? But I think you should definitely go for math&physics, but don't pressure yourself. computer programing's also important, it will be really useful like when you wanna apply for a job or something two things they look at is your computer skills and your second language.

How many days a week do you take classes by the way?

Content: 6 Organization: 4 Vocabulary: 5

As can be seen in the above excerpts, there were frequent instances of incorrect spelling such as "some thing" (line 8) and incorrect use of relative pronoun, "that"(line 1) instead of "who" for human beings in Paria's first journal entry. But these problems had been eliminated in her last entry (lines 2 & 4). This supports the idea that although focus on form in DJW practices is de-emphasized, the authentic language that the NNS students exposed to serves as a model of corrects language use. Whereas her first entry was not rich in content and difficult to understand because of frequent mistakes and incorrect language use, her last entry had significantly developed and was easier to follow and there were more signs of grasping the topic. It is worth mentioning that special features of CMC context, the use of special abbreviations and acronyms (lol/nope) and informal language (how r u/gonna/wanna) and features of speaking (Warschauer,

2007; Lingley, 2005) caused the language produced to be informal. Stapa and Al-Bakri (2001) argue that authenticity of language signifies that the "writing activity is truly communicative", thus, the students "are communicating because they need to and want to communicate" (p. 34).

The vocabularies used in the first entry were quite simple and limited. To cite an example, frequent use of the general adjective 'good' for describing satisfactory quality of different things can be seen in her first journal entry while her last entry involves more distinctive adjectives such as, marvelous and acceptable and adverbs such as definitely and really . However, the organization of the writing was not consistent enough. Yet, the 'organization' of the last entry had improved in comparison with her first entry. Despite the fact that the writing did not have a very fixed plan, the paragraphs were adequately unified.

## Conclusion

SCT places great importance on the role of interactive environment and CMC-based language learning suggest a way of fostering language learners' social interaction. With email as asynchronous form of CMC, it can be more motivating for students to write. The implementation of E-DJW in this study provided an interactive Sociocultural framework for student learning. Email correspondence with native speaker pals could positively influence the NNS students' writing development in that, the students' writing proficiency improved in three aspects of content, organization, and vocabulary. DJW makes writing a contextualized and purposeful communicative activity. By incorporating DJW in writing classrooms, not only students develop their writing skill but also their social and cultural awareness of the world increases as a result of exposure to authentic language. Likewise, independent learning which is essential in L2 writing is facilitated (Razak & Asmawi, 2004) and meaningful learning is promoted. As Mayer (2003) described three processes are required for meaningful learning to take place. These are: attend, organize, and integrate. Learners must pay attention to the relevant and important content, they must organize the content structurally, and they must integrate the content into their existing cognitive structure. So, "DJW might be the all-in-one missing practice that many EFL writing teachers are looking for in order to simultaneously teach the mechanics of writing, meaningful written communication, socially and personally aware writing practices, and learning for a more meaningful life" (Mirhosseini, 2009, p. 46). The findings of this study suggest the application and the positive influence of E-DJW practices, but due to the limited scope and sample size of the study, more research in E-DJW will deepen our understanding of the effect of E-DJW on students' writing improvement.

## References

Barnard, R., & Campbell, L. (2005). Sociocultural theory and the teaching of process writing: The scaffolding of learning in a university context. The TESOLANZ Journal, 13, 76-88.

Donato, R. (1994). Collective Scaffolding in second language learning. In J.P. Lantolf & G. Apple (eds.), Vygotskian approaches to second language research. Norwood, NJ: Albex, 35-56.

Faigley, L., Daly, J.A., & Witte, S.P. (1981). The role of writing apprehension in writing performance and competence. Journal of Educational Research, 75(1), 16-21.

Gonzáles-Bueno, M. (1998). The effects of electronic mail on Spanish L2 discourse. Language Learning & Technology, 1(2), 55-70.

Ferris, D., & Hedgcock, J. S. (1998). Teaching ESL composition: Purpose, process, and practice. Mahwah, NJ: Lawrence Erlbaum.

Holmes, V. L.,& Moulton, M. R. (1997). Dialogue journals as an ESL learning strategy. Journal of Adolescent & Adult Literacy, 40, 616-626.

Liao, M., & Wong, C. (2010). Effects of dialogue journals on L2 students' writing fluency, reflections, anxiety, and motivation. Reflections on English Language Teaching, 9(2), 139-170.

Lin, P., & Yang, H. (2010). Dialogue journal writing via email: A case study of two non-English majors. Retrieved 17 March 2011 from: http://140.127.82.166/bitstream/987654321/2036/1/18.pdf

Lingley, D. (2005). Spoken features of dialogue journal writing. Asian EFL Journal, 7(2), 48-67.

Lucas, T. (1990). Personal journal writing as a classroom genre. In J.K. Peyton (Ed.), Students and teachers writing together: Perspective on journal writing (pp. 9-123). Alexandria, VA: Teachers of English to Speakers of Other Languages.

Mayer, R. E. (2003). The promise of Educational psychology: Teaching for meaningful learning. Merrill Prentice Hall.

Mirhosseini, Abdolhamid. (2009). For our learn of English: Dialogue journal writing in EFL education. Prospect: An Australian Journal of TESOL 24(1), 40-48.

Nassaji, H., & Cumming, A. (2000). What's in a ZPD? A case study of a young ESL student and teacher interacting through dialogue journals. Language Teaching Research, 4, 95-121.

Pennington, M. (1996). Writing the Natural Way: On computers. Computer Assisted Language Learning, 9(2-3), 125-142.

Pi, H. Y. (2002). Interactive writing via email: A case study of three elementary school students. Unpublished master's thesis, National Taipei Teachers College, Taipei, ROC.

Peyton, J. K. (1987). Dialogue journal writing with Limited-English-proficient (LEP) students. ERIC Report. Washington, DC: Center for Applied Linguistics.

Razak, R. A., & Asmawi, A. (2004). The use of dialogue journal through e-mail technology in developing writing interest and skills. Malaysian Online Journal of Instructional Technology, 1(2), 14-23.

Stapa, S. H., & Al-Bakri, I. S. M. A. (2001). Achievement of male and female students using E-dialogue journal writing. Journal Teknologi, 35(E), 33-44.

Vygotsky, L.S. (1978) Mind in Society: The development of higher psychological processes. Cambridge, MA: Harvard University Press.

Wang, Y. M. (1994). Email dialogue journal writing in an ESL reading and writing classroom. Unpublished PhD thesis, University of Oregon.

Warschauer, M. (1995). E-mail for English Teaching. Alexandria, VA: TESOL Publications.

Warschauer, M. (1997). Computer-mediated collaborative learning: Theory and practice. Modern Language Journal, 8 (3), 470-481.

Warschauer, M. (2007). Technology and writing. In C. Davison & J. Cummins (Eds.), The International Handbook of English Language Teaching (pp. 907-912). Norwell, MA: Springer.

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# Appendix A

Adapted from Ferris & Hedgcock (1998), pp. 239-240

| | | | |
|---|---|---|---|
| ***Content*** | | | |
| | **Level** | **Score** | **Features** |
| | Excellent | 8 | Superior understanding of topic and writing context; valuable central purpose defined and supported with sound generalizations and substantial, specific, and relevant details; rich, distinctive content that is original, perceptive, and/or persuasive; strong reader interest |
| | Good | 6 | Accurate grasp of topic and writing context; worthwhile central purpose clearly defined and supported with sound generalizations and relevant details; substantial reader interest. |
| | Fair | 4 | Acceptable but cursory understanding of topic and writing context; routine purpose supported with adequate generalizations and relevant details; suitable but predictable content that is somewhat sketchy or overly general; occasional repetitive or irrelevant material; one or two unsound generalizations; average reader interest |
| | Poor | 2 | Little or no grasp of the topic or writing context; central purpose not apparent, weak |
| ***Organization*** | | | |
| | Excellent | 8 | Exceptionally clear plan connected to purpose; plan developed with consistent attention to proportion, emphasis, logical order, flow, and synthesis of ideas; paragraph(s) coherent, unified, and effectively developed; striking title, introduction, and conclusion |
| | Good | 6 | Clear plan related to purpose; plan developed with proportion, emphasis, logical order, and synthesis of ideas; paragraph(s) coherent, unified, and adequately developed; smooth transitions between/within paragraphs; effective title, introduction, and conclusion |
| | Fair | 4 | Conventional plan apparent but routinely presented; paragraph(s) adequately unified and coherent, but minimally effective in development; one or two weak topic sentences; transitions between/within paragraphs apparent but abrupt, mechanical, or monotonous; routine title, introduction, and conclusion |
| | Poor | 2 | Plan not apparent, inappropriate, undeveloped, or developed with irrelevance, redundancy, inconsistency, or inattention to logical progression; paragraph(s) incoherent, underdeveloped, or not unified; transitions between/within paragraphs unclear, ineffective, or nonexistent; weak or ineffective title, introduction, and conclusion |
| ***Vocabulary*** | | | |
| | Excellent | 8 | Vocabulary distinctive; fresh, precise, concrete, economical, and idiomatic word choice |
| | Good | 6 | Clear, accurate, and idiomatic vocabulary; minor errors in word form and occasional weaknesses in word choice |
| | Fair | 4 | Satisfactory vocabulary; generally accurate, appropriate, and idiomatic word choice, though occasionally predictable, wordy, or imprecise; limited vocabulary; clarity weakened by errors in S-V and pronoun agreement, point of view, word forms |
| | Poor | 2 | Vocabulary unpredictable, inappropriate, non-idiomatic, and/or inaccurate word choice that distracts the reader or obscures content; numerous word form errors |

**Total score:** /24

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**Editor's Note**: In distance education, learning communities facilitate social interaction that engages students and promotes learning. Rather than criticizing distance learning for what it is not (face-to-face), we should capitalize on its peculiar advantages for social networking, dialog, and exploration of ideas. In the traditional classroom, many voices remain silent because time is limited and the environment is competitive. In the virtual community, social interaction can build collaboration, teamwork, and mutual support.

# Social Interaction as a Contributor to Significant Learning Outcomes in Online Instruction

**Tara Newman, Mary Olle, Carol Bradley**
**USA**

**Keywords:** Academic engagement, engaged community, constructivism, learning outcomes, online learning, effective online instruction, methodologies, recommended practices, distance education, interaction, facilitator, collaborative learning, technology, retention, flexibility, feedback, family science, feedback, student to student interaction

## Introduction

There has been a dramatic increase in online coursework in higher education over the past decade. According to Allen and Seaman (2010), there was a 17% growth in online enrollments between 2007 and 2008. While many institutions offer only single courses online, others offer entire degrees and students at all educational levels (from primary school through graduate school) are choosing to participate in courses through a distance format, including hybrid and fully online options.

Several reasons are cited as contributors to this rapid growth. Principally, recent economic shifts have increased a demand for more flexible options to achieve the continuing education credits, certifications, and/or degrees necessary to retain current positions, seek advancement, or acquire new employment. Indeed, 87% of public institutions surveyed attributed economic concerns as a contributing factor to the increased demand for online courses and programs (Allen & Seaman, 2010; Young, 2006). Not only are economic concerns motivating learners to seek online offerings, but institutions are finding that by offering courses online, they, too, can utilize their declining resources more effectively. For example, a reduction in photocopies results in financial savings both in materials and employee time.

In addition to the economic motivators for online coursework, some authors assert that the flexibility offered when teaching online courses is especially appealing to faculty (Li & Irby, 2008; Young, 2006). Instructors who gravitate toward teaching in the online environment may do so primarily for the flexibility it provides to address professional responsibilities outside of teaching, such as research and service, as well as personal obligations. Furthermore, because all course-related information (i.e. class rosters, student correspondence, grades, submitted assignments) is contained and compartmentalized within the learning management system, faculty are not restricted to an office or classroom to meet their students' needs.

It is well documented that online offerings also permit students the flexibility to manage their daily work and personal responsibilities with the demands of higher education (Li & Irby, 2008; Park & Choi, 2009). Moreover, by participating in online courses, they are able to save money on the extra expenses associated with attending face-to-face classes, such as travel, hard copies of materials, and care for family members in their absence.

Each of the aforementioned factors contributes to the increase in online course enrollment. It is apparent that online course work is a benefit to institutions, faculty, and learners alike and will likely continue as a major component of higher education (Dawley, 2007). Therefore, it is critical to understand the elements of high quality online instruction, particularly in programs that are preparing emerging professionals to enhance the lives of individuals, families, and communities.

### *Theoretical and Philosophical Foundation*

Effective online teaching requires a commitment to developing caring relationships in the virtual world. In the face-to-face classroom, students who are emotionally present tend to engage in spontaneous informal discussions about the content of the course before and after class, during breaks, and even in other settings (Picciano, 2002). Emotional presence also contributes to informal content-based interactions in the online environment; although, unlike the face-to-face setting, the instructor designs the environment to intentionally stimulate these informal interactions.

The principal concept supporting this intentional design is rooted in a dialectical constructivist philosophy. Incorporating research-based practices that have been demonstrated to generate engaged community fosters increased social interaction in the online setting, and it is these meaningful interactions that later lead to significant learning outcomes. These authors suggest the following model to demonstrate this process.


***Figure 1.*** **The process leading to significant learning.**

At the heart of dialectical constructivism are the following ideas:

- knowledge is constructed by the learner;
- construction of knowledge is socially mediated;
- knowledge is meaningful only in the context in which it is received; and
- new knowledge is built upon the prior knowledge of the learner (Bruning, Schraw, & Norby, 2011).

Therefore, the online environment should be designed in such a way that students have opportunities to construct appropriate knowledge with others in situations where the content is woven into a meaningful context and intentionally builds upon what learners already know (Yang, Yeh, & Wong, 2010).

Experiences such as those previously described are seen in both high-quality online and face-to-face classrooms; however, Bruning, Schraw, & Norby (2011) assert that well-developed computer-based environments can foster deeper learning (including metacognition and self-regulation skills) then what typically develop in traditional classrooms. One must remember, though, it is not the technology itself that induces these advanced outcomes, but rather how the technology is used (Bruning, Schraw, & Norby, 2011).

The idea of utilizing certain methodologies in the teaching process is a fundamental component of the field of education. When discussing effective online instruction, one must realize that there is an overarching philosophy involved, not only a set of strategies. It is one's philosophy that guides the educator in his/her teaching methodology, not merely the desire to implement new strategies

(Brooks & Brooks, 1999; DeVries, Zan, Hildebrandt, Edmiaston, & Sales, 2002; Fosnot, 2005; Noddings, 2002).

With that in mind, educators who are interested in enhancing student learning outcomes realize that with the expectation that students develop as problem solvers, critical thinkers, and effective communicators, a simple set of strategies is insufficient (Cagnon & Collay, 2001). Therefore, the focus shifts from regurgitation of information to actual learning. Indeed, Fosnot and Perry (2005) state that the focus moves toward cognitive development and deep understanding, rather than a superficial demonstration of factual knowledge. When learners reach that level of achievement, they are then demonstrating that not only can they access the information they seek but they can also apply that information – two very important objectives of the educative process (Cagnon & Collay, 2001).

In a constructivist environment, these objectives, both for knowledge as well as skills and processes, are formatively assessed. This can clearly be seen in the face-to-face classroom where a teacher serves as a facilitator of knowledge while the learner is its constructor. It is similarly demonstrated in the online environment when the instructor is skilled in the art of facilitating constructive learning online, resulting in a sense of community and social interaction which, in turn, lead to desired student learning outcomes. An effective online educator understands the perspective of his/her students thereby allowing for enhanced interaction with the content through the use of discussion and elaboration of the learners' ideas (DeVries et al., 2002; Dewey, 1985; Marlowe & Page, 1998).

The following recommended practices hold their origins in the philosophical and theoretical framework as presented in this section. The reader should note the emphasis on community development, participant engagement, and student learning outcomes as facilitated by interaction with peers, academic content, and instructors.

## Recommended Practices

In this section, a variety of recommended practices are presented that reflect the philosophy outlined above. In addition, the authors share personal experiences about the implementation of these practices in both graduate and undergraduate courses in several areas of family science. Intentionally planning for both formal and informal interactions is a critical component of effective online instruction. These authors recommend focusing on the triangular strategy of facilitating meaningful interactions among peers, content, and instructor.

### *Interactions with Peers*

Social constructivists expect the learning process to involve interaction with other people and/or environments (Huang, 2002). Successful peer-to-peer interaction contributes to a greater sense of community, increased learner motivation and enthusiasm (Dawley, 2007; Huang, 2002; Robin Smith, 2008). In addition, peer-to-peer interactions contribute to strengthened critical thinking and problem solving skills as outcomes. Peer collaborations facilitate the co-construction of new knowledge (Regina Smith, 2008), which is the primary goal in education.

### *Interactions with Content*

A key element of a constructivist philosophy is "the way in which students interact with, come to learn, and come to understand content" (Marlowe & Page, 1998, p. 65). Teachers who practice through a constructivist lens select content that is challenging to the learner. They adhere to the principal that it is important to connect academic content with real-world problems (Huang, 2002).

The degree to which students interact with the content depends upon the course design (Swan, 2003). Developing content that is readily accessible enables students to take ownership of their

learning. Students can revisit content as needed. In other words, they can spend more time on concepts that they find difficult and less time on those that they deem less challenging.

Content presented using meaningful examples helps students make important connections. While content itself is important, it is the instructor who creates the bridge between the content and the learner. (Robin Smith, 2008).

### *Interactions with Instructors*

The role of the instructor in the online environment is that of a facilitator. Instructors lead students through the content rather than dispense knowledge. As they serve as models of good communication, they eliminate isolation and foster both social and academic engagement (Dawley, 2007). Highly interactive instructors strive to address the social need of learners, as well as their academic needs. They empower them to pursue the information they need (Cercone, 2008; Dawley, 2007) to be successful in both arenas.

Without the scaffolded interaction a skilled instructor can provide, the online class risks being a digital correspondence course (Conrad & Donaldson, 2004) that may result in an ineffective acquisition of content.

To fully benefit from the opportunities afforded by online instruction, the trio of interactions - among peers, content, and instructors - must be employed. Through the use of effective practices, engaged learners spontaneously connect socially, resulting in significant learning outcomes. In the following section, the authors share their experiences with incorporating these practices into their own classes.

## Incorporating Effective Practices

Small groupings of students are encouraged to promote a deepened sense of community among all class members in which a co-construction of knowledge can occur. Furthermore, social interaction has a positive effect on the amount of information retained as well as on the length of retention. Learning that occurs through small groups frequently mimics real life tasks and problem solving (Dawley, 2007).

Collaborative learning through small groupings has successfully been incorporated into online courses through intentionally and/or randomly generated learning teams; asynchronous discussions; and scenario analysis activities. These practices are further explained in this section.

### *Learning Teams*

In some courses, instructors find that high enrollment numbers create a sense of loneliness within the online environment. The spontaneous connectedness that seems to develop in face-to-face classes needs to be intentionally fostered. When not provided with meaningful opportunities to interact with fellow learners in an online class, students can feel isolated. In order to decrease this feeling – and increase a sense of community - some instructors elect to form classes within a class by creating learning teams (LT). These LT are the basis for semester-long engagement in the course. A majority of the content-based interactions are with the same LT members, which contributes to strengthened relationships over the course of the semester and/or program. These relationships allow for a degree of trust that permits students to freely share ideas and questions without fearing judgment. The rapport that develops among the learning teams persists beyond individual courses and even into the professional realm.

Learning teams can be formed by intentional or random grouping methods. There are benefits to both methods and the decision to choose one or the other depends on the course content, class enrollment, and philosophy of the instructor. These authors have experience using both forms of grouping and share the following insights.

**Randomly generated learning teams.** Most learning management systems have a feature that randomly generates groups. Utilization of these tools is an easy way to organize students. Random grouping simulates "real life" where professionals are required to work with people that may be very different than themselves. When learners have the opportunity to interact with diverse perspectives, they are also provided the opportunity to develop advanced professional communication skills.

**Intentionally generated learning teams.** While more time-intensive, intentionally-generated learning teams can also be beneficial to student learning. For example, in a survey or foundations course, where a variety of majors are enrolled in the same class, teams can be formed by discipline to facilitate connections among emerging professionals in the same field. Learners can expand on the theories or concepts being studied in the class by applying them to their specific area of study. The similar backgrounds of those in the same field enable students to examine content through a common lens resulting in both personal and professional connections.

### *Asynchronous Discussions*

Using asynchronous discussions for learning-teams to interact about content is one strategy used to foster an engaged learning community. The process of "type, post, wait, and read before responding" encourages students to stay focused longer on one topic (Dawley, 2007, p. 127) and stimulates open dialogue that bonds learners to content and one another.

Small group discussions are a structured way for students to interact. It is during these structured conversations that an engaged learning community evolves, leading to the spontaneous social interactions that are essential to significant student learning (see Figure 1).

To create the engaged learning community desired, it is imperative for instructors to use effective practices. As Robin Smith (2008) explains, "good discussion questions elicit discussion" (p.89). A good question should be open ended, allow for expression of individual perspectives, and be directly connected to the content. As students maneuver through difficult conversations, they build relationships that transition from obligatory classroom discussions to spontaneous and social interactions involving the content.

### *Scenarios*

Presenting students with a scenario to analyze as a group is a valid option for use in the asynchronous (discussion board) *or* synchronous (chat). By asking students to apply the course content to a real-life situation, they synthesize a variety of perspectives to produce appropriate solutions or responses. Offering a scenario as the focus of a group discussion can promote critical thinking among the members of a group and "…mimics today's specialized work environments where employees are often required to work as a part of a team toward achievement of a larger goal" (Dawley, 2007, p. 100).

Both randomly and intentionally formed learning teams benefit from scenario analysis activities. Intentionally-formed groups, linked by a similar background, may share overlapping perspectives on issues presented in the scenario whereas a random combination of varying backgrounds may generate a wider variety of responses and perspectives. Regardless of the group composition, a sense of camaraderie can arise as students ponder possible responses to a situation which further contributes to significant learning outcomes.

### *Open Forum*

It is imperative to use effective practices that lead to structured interaction with peers, content, and instructors. The use of directed asynchronous discussions and scenario analysis activities provide such opportunities. Once students have engaged with the learning community, they may find themselves seeking an outlet for social interactions with their peers. One way to mimic the

side conversations students have in the face-to-face environment is to create places online that are specifically designed for non-graded social interactions.

The use of an "open forum" in the asynchronous discussion board is one strategy used to further facilitate social interaction. In the open forum, students can post questions for one another (related to content or not), share information deemed of possible interest to others, and/or engage in general chitchat. This informal environment can be less intimidating to students, increasing participation through casual social discussions and contributing to a greater sense of belonging. Because they can openly discuss topics of their choosing, interdependence and cohesion develop among the students, further contributing to emotional presence within the course. Students who interact in the open forum are not only cognitively and emotionally stimulated, but are socially fed, as well (Dawley, 2007).

## Implications

Since the growth in online coursework does not appear to be declining in the near future, it is imperative for faculty in higher education to increase their effectiveness in electronic delivery of academic content. The philosophy and strategies discussed in this paper have numerous implications for the field of higher education.

By offering student-centered instruction through electronic means, educators are preparing future professionals to function in the workforce in ways that might not be possible in the face-to-face classroom. Because students are essentially forced to complete assignments using electronic methods, they gain experience with those tools that will enhance their work in their future careers. These professionals will be better equipped to serve their prospective employers and clients, who will expect communication in various electronic formats (webpages, e-mails, social networking sites, e-newsletters, etc.). It is imperative that we prepare the emerging workforce to face the challenges of communicating in the digital age.

Students are learning how to function in the modern work environment in additional ways. The modern work environment frequently expects employees to collaborate to achieve a common goal (Dawley, 2007). Interpersonal skills acquired in the virtual classroom are transferrable from the online academic setting to a variety of work environments.

Due to the lack of informal social connect frequently found in distance learning, student retention is lower for online than face-to-face courses (Allen & Seaman, 2010; Picciano, 2002). The need to develop meaningful virtual interactions is intensified by the strong connection between student engagement and retention. These interactions are the key to learners' desire to persist (Kemp, 2002), which results in significant learning outcomes. Additionally, an institution's retention and graduation rate is directly related to their budget, which is especially critical in the current economic condition.

## Conclusion

The rapid growth of distance education makes it clear that those in higher education need to pay attention to the needs of online learners to a greater degree. The tenets outlined in this paper exemplify effective online pedagogy. By incorporating strategies that lead to an engaged learning community, learners are more likely to exhibit informal social behavior. These authors maintain that it is these informal interactions that contribute to the construction of significant learning outcomes.

## References


Allen, I., & Seaman, J. (2010). *Learning on demand: Online education in the United States, 2009*. Babson Survey Research Group.

Brooks, J. G., & Brooks, M. G. (1999). *In search of understanding: The case for constructivist classrooms*. Alexandria: Association for Supervision and Curriculum Development.

Bruning, R., Schraw, G., & Norby, M. (2011). *Cognitive psychology and instruction*. Boston: Pearson.

Cagnon, G. W., & Collay, M. (2001). *Designing for learning: Six elements in constructivst classrooms*. Thousand Oaks, CA: Corwin Press.

Conrad, R., & Donaldson, J. (2004). *Engaging the online learner: Activities and resources for creative instruction*. Jossey-Bass.

Dawley, L. (2007). *The tools for successful online teaching*. Hershey, PA: Information Science Publishing.

DeVries, R., Zan, B., Hildebrandt, C., Edmiaston, R., & Sales, C. (2002). *Developing constructivist early childhood curriculum: Practical principles and activities*. New York: Teacher's College Press.

Dewey, J. (1985). *Democracy and education: 1916*. Carbondale: Southern Illinois University Press.

Fosnot, C. T. (2005). Teachers construct constructivism: The center for constructivist teaching/teacher preparation project. In C. T. Fosnet (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 263-275). New York: Teachers College Press.

Fosnot, C.T., & Perry, R. S. (2005). Constructivism: A psychological theory of learning. In C. T. Fosnot (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 8-38). New York: Teachers College Press.

Huang, H. (2002). Toward constructivism for adult learners in online learning environments. *British Journal of Education Technology, 33*(1), 27-37.

Kemp, W. C. (2002). Persistence of adult learners in distance education. *The American Journal of Distance Education, 16*(2), 65-81.

Li, C., & Irby, B. (2008). An overview of online education: Attractiveness, benefits, challenges, concerns and recommendations. *College Student Journal, 42*(2), 449-458.

Marlowe, B. A., & Page, M. L. (1998). *Creating and sustaining the constructivist classroom.* Thousand Oaks, CA: Corwin Press.

Noddings, N. (2002). *Educating moral people: A caring alternative to character education.* New York: Teachers College Press.

Park, J., & Choi, H. (2009). Factors influencing adult learners' decision to drop out or persist in online learning. *Educational Technology & Society, 12*(4), 207-217.

Picciano, A. (2002). Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *The Journal of Asynchronous Learning Networks, 6*(1), 21-40.

Smith, R. [Robin]. (2008). *Conquering the content: A step-by-step guide to online course design.* San Francisco, Jossey-Bass.

Smith, R. [Regina]. (2008). Adult learning and the emotional self in virtual online contexts. *New Directions for Adult and Continuing Education, 120*, 35-43.

Swan, K. (2003). Learning effectiveness: What the research tells us. In J. Bourne & J. C. Moore (Eds) *Elements of Quality Online Education, Practice and Direction.* Needham, MA: Sloan Center for Online Education, 13-45.

Yang, Y., Yeah, H., & Wong, W. (2010). The influence of social interaction on meaning construction in a virtual community. *British Journal of Education Technology, 41*(2), 287-306.

Young, S. (2006). Student views of effective online teaching in higher education. *The American Journal of Distance Education, 20*(2), 65-77.

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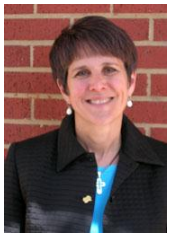

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**Editor's Note**: Self-instructional methods are facilitated by interactive technologies and they result in improved learning and performance. This study compares conceptual learning and skill development from a computer simulation to a control group learning by traditional methods.

# Impact of Computer Strategies on Self-Learning to Improve Cognitive Skills

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**India**

## Abstract

Self-learning computer simulation packages have been successfully used to promote conceptual growth in understanding and skill developing among the learners. Simulations show enhancement in understanding and problem solving abilities. A full-fledged self-learning interactive tool motivates the learner, develops self-confidence, and improves understanding of concepts.

This study examines the effect of interactive computer simulation package (ICSP) for conceptual understanding of semiconductor and its applications. An important objective of present study is active learning rather than passive viewing and listening. The effect of this package on learners is compared with traditional learners. The present paper describes the attempt and discusses results.

**Keywords**: Simulation package, experimental, control, class average, significant, learner's performance.

## Introduction

The change in pedagogy creates a great influence among the learners. The new approach of self-learning promotes enhancement in skill development and conceptual understanding. Traditional approaches to teaching semiconductor concepts consist of presenting subject material through lectures, in which learners play nearly passive role. [16] Due to this, it is observed that the students remain far from the conception of teachers. If such concepts are not clear, its application becomes difficult.

This paper reports the investigation into the role of diverse representation in the learning of semiconductor concepts. The goal of the study is to identify potential and actual obstacles to student learning and then to address these obstacles in a way that leads to more effective learning.

Improving our standard of teaching using active learning methods [10] is more important today than ever before. First step in evaluating the success of any curriculum is to examine the goals of the course. The main goal in most traditional classes is to determine mastery of the course material through typical end of chapter problems on course assignments and examinations. However most of the teachers' goals for their students go beyond this. These learning goals are not listed in the syllabus or in the textbook. But those who have mastered the main goal of solving end of chapter problems have weak grasp of basic concepts. So there is need of designing such type of method that fulfills our expectations.

Evaluation of teaching materials, which is considered an essential part of their design, refers to empirical research intended to discover how successful the materials are for learners. Method for evaluation includes process-oriented observations of learners working on any tasks. SLA (Second language acquisition) research [3] provides some clear guidance for the evaluation of instructional activities. First empirical evaluation of learners task use is seen as critical for making judgments about the quality of the task.

A central role and the process- awareness of authoring tools [2] are reflecting the semantic evaluation of e-learning systems. The purpose of this study is to outline the state-of-the-art

research along evolution and to suggest a realistic way towards the educational semantic web. Allyn Radford [13] implies the strategic development of educational models that are designed to exploit current technological opportunities by placing the issues in context and challenging both new and traditional models. The interactive communication tools will transform our capability to embrace an educational paradigm that deals with learning as a vital, fulfilling and continuing part of life at home and in the workplace as well as within educational institutions. The analogies can be used productively to teach in a large enrollment course. [12]

In MBL (Microcomputer-based Laboratories experiments) laboratory [14] students do real hands-on experiments where real-time displays of the experimental results facilitate conceptual growth. The students can immediately compare their predictions with the outcome of an experiment, and students' alternative conceptions can thus successfully be addressed. MBL is an active engagement approach, which is proven to be an effective way of fostering conceptual change in mechanics. Students need to make use of as many senses as possible in their meaning making and thus approaches which make use of both hands-on and high technology tools seem to be very effective. And short memory is converted in to long memory by repetitions, practice and application of diverse problems. [11]

## Project development

### *Package Design:*

The simulation package is organized into following topics:

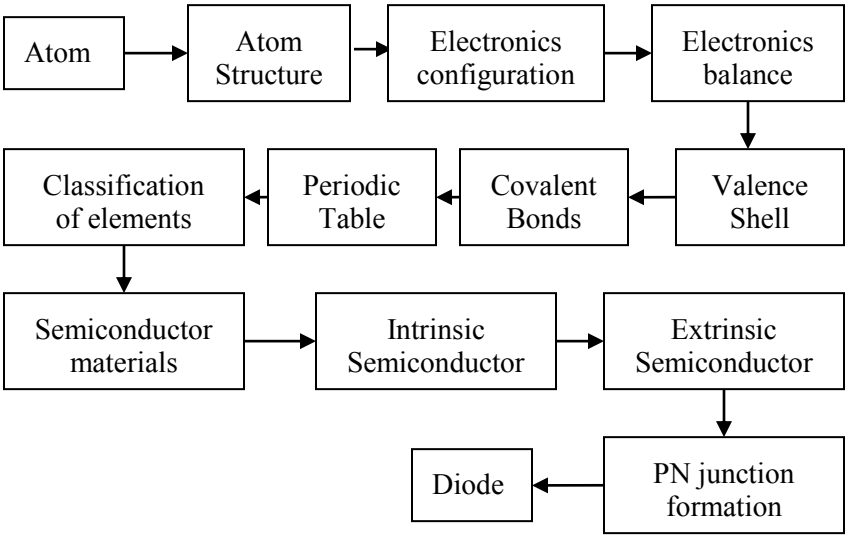


**Figure 1: Project development**

### *Objectives:*

The developed package is on the semiconductor concepts, which has been designed with specific learning objectives.

Since it is necessary for conceptual understanding to start from the structure of an atom, bonds in an atom, types of material etc. and it is extended up to the p-n junction formation.

Theoretical background is presented with audio-visual technique. [4-6, 8] In some places movement of electron is shown to explain the concepts. [15]

Since computer simulation package on semiconductor concepts is a cognitive tool. conceptual understanding can be improved by selectively choosing a particular topic representation.[1, 7, 9]

By using package students can acquire knowledge that justifies the need, and produces better results than those obtained theoretically.

### *Procedure*

In the first phase of research pretest was conducted for checking initial knowledge of target group and marks obtained by the students were noted. After taking the pretest of all students, they were divided into two groups as control group and experimental group. The experimental group students were asked to study the computer simulation package. This simulation package is done with the help of series of interactive animated slides with relevant audios attached. Topics are explained with the help of audio-vision supported by animation. Students were given a freedom to repeat a topic till their satisfaction. Posttest was given to both groups after applying the solution methods on both the group.

Figure 2 shows the implementation strategy used.

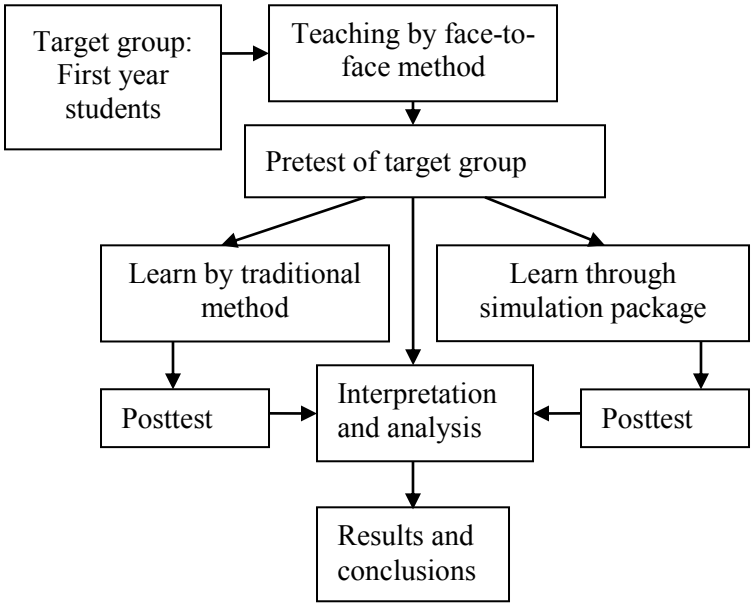


**Figure 2: Implementation strategy**

## Results and Discussion

### *Performance of target group in pretest:*

**Table 1: Performance of Pretest.**

| Group | Pretest | Values | T-Value |
|---|---|---|---|
| Control | N1 | 30 | 0.3241 |
| Group | Mean | 35.5 | |
| | S. D. | 12.55 | |
| Experimental | N1 | 30 | |
| Group | Mean | 34.5 | |
| | S. D. | 11.32 | |

### *Data analysis of control group:*

After the pretest, traditional teaching method is applied to the control group using the method rise in score of the posttest is observed, which is shown graphically.

Graphical representation of performance of control group:

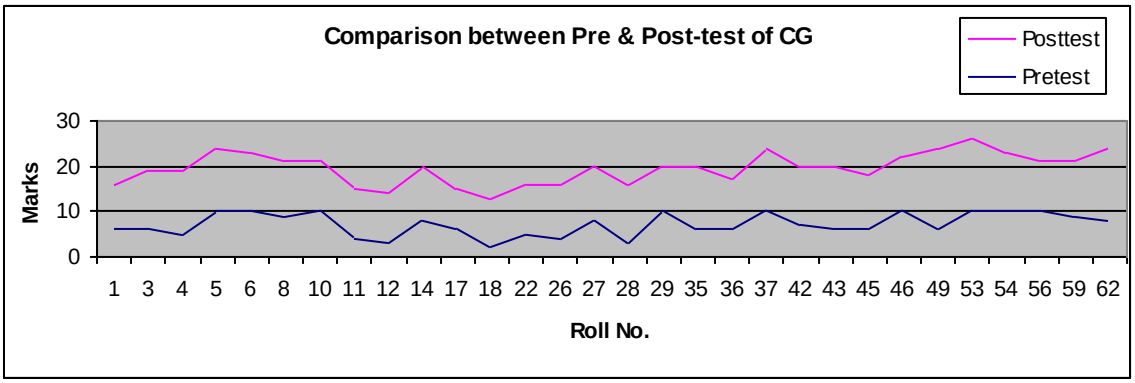


**Figure 3: Comparison between scores of pretest and posttest of control group.**

**Table 2**
**Pretest and Posttest data of control group**

| Test | No of Students | Mean | S. D. | <g> |
|---|---|---|---|---|
| Pretest | 30 | 35.5 | 12.55 | 0.4007 |
| Posttest | 30 | 62.5 | 9.715 | |

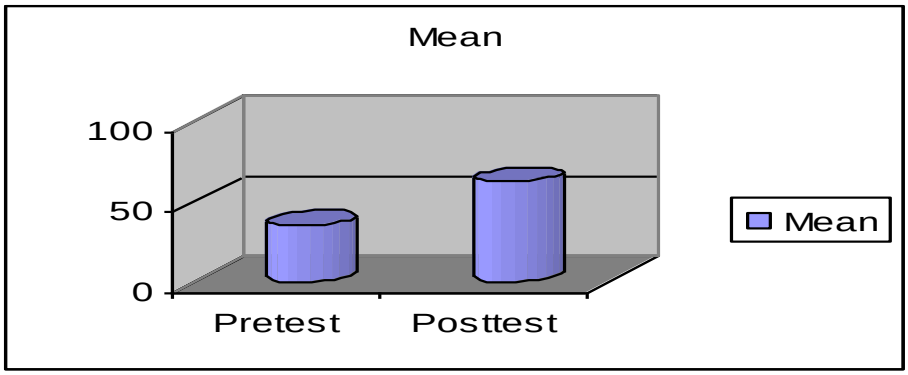


**Figure 4: Comparison between means of pretest and posttest of control group.**

### *Data analysis of experimental group:*

After the pretest, experimental method (use of software package) is used for the experimental group. Using the method rise in score of the posttest is observed, which is shown graphically.

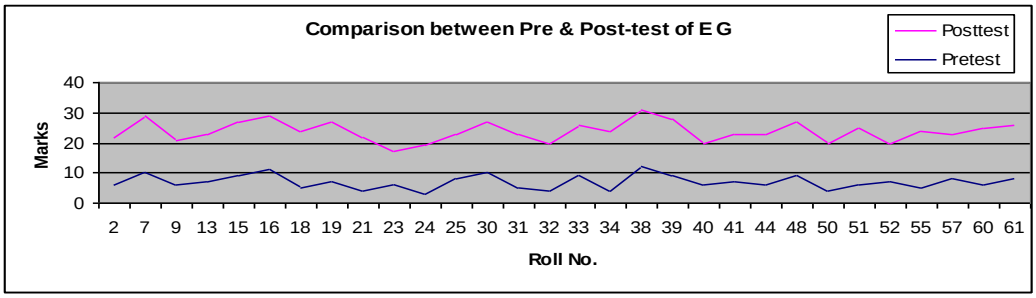


**Figure 5: Comparison between scores of pretest and posttest of experimental group.**

**Table 3**
**Pretest and posttest data of experimental group.**

| Test | No of Students | Mean | S. D. | <g> |
|---|---|---|---|---|
| Pretest | 30 | 34.5 | 11.32 | 0.7724 |
| Posttest | 30 | 85.5 | 10.625 | |

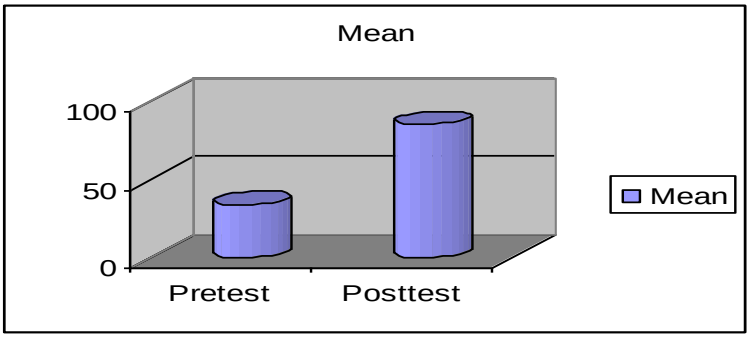


**Figure 6: Comparison between means of pretest and posttest of experimental group.**

***Comparison between pretest and posttest of both the groups:***

Experimental group shows effective gain in the scores of posttest as compared to control group. Now the next comparison is between pretest and posttest, control group and experimental group, which is shown in the following table.

**Table 4**
**Performance of pretest and posttest of control group and experimental group.**

| Group | | Pretest | Posttest | <g>& SD | T-value |
|---|---|---|---|---|---|
| Control Group | N | 30 | 30 | | |
| | Mean | 35.5 | 62.5 | 0.4007 | |
| | S D | 12.55 | 9.715 | 0.184 | |
| Experimental Group | N | 30 | 30 | 8.466 | |
| | Mean | 34.5 | 85.17 | 0.7724 | |
| | S D | 11.32 | 10.625 | 0.1553 | |

***Comparison of posttest scores of control group and experimental group:***

**Table 5**
**Comparison of mean and S.D between control group and experimental group.**

| Term | Control Group | Experimental Group |
|---|---|---|
| Mean | 62.5 | 85.17 |
| S D | 9.715 | 10.625 |

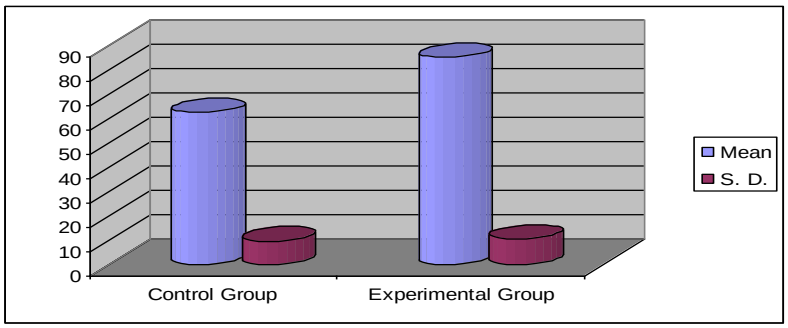


**Figure 7: Comparison of mean and S.D between control group and experimental group.**

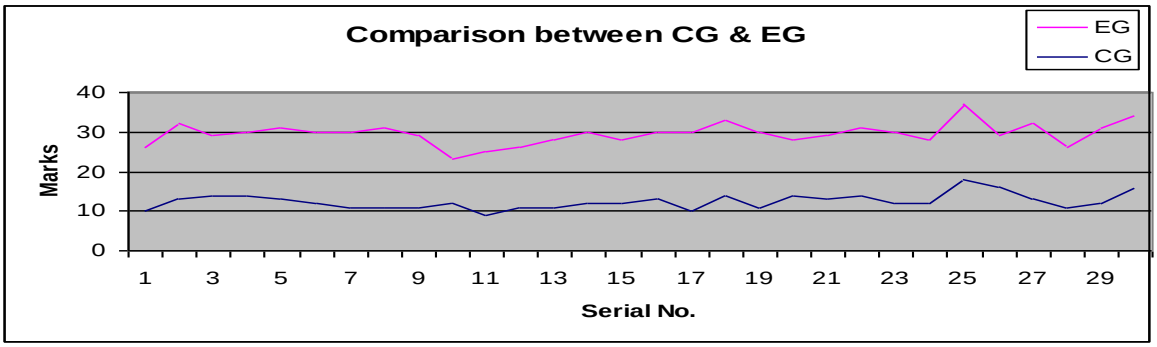


**Figure 8: Performance of experimental group is higher than the control group.**

## Conclusion:

The normalized gain of control group is 0.4007 and that of experimental group is 0.7724. The t-test was conducted on normalized gain of both the groups. The class average normalized gain for experimental group is significantly higher than the control group. This difference is significant at the 0.01 alpha levels. The t-value is 8.466, which is higher than standard table value 2.756. So the method used for experimental group is effective, which shows significant difference in the learners' performance.

## References

[1] Anderson J., (1983), *The architecture of cognition* Cambridge, Harvard University Press.

[2] Aroyo, L., (2004); Department of Mathematics and computer Science 5600 MD Eindhoven, Vol 105,

[3] Chappell, C. A., (1998); 'Multimedia Call: Lessons to be learned from research on instructed SLA. Language learning and technology in society.' *Educational Technology and society*, 8(3) 103-109.

[4] Gaikwad M G, Sahashrabudhe C, (1994), *National seminar on Management and Planning of Engineering Institutions*, Shegaon (Maharashtra).

[5] Gaikwad M G, Vadnere R, (1994) *Media and Technology for Human Resources Development (MTHRD), Wiley Eastern Ltd., New Delhi,* Vol. 6, P3

[6] Gaikwad M G, Vadnere R, (1995), *Indian Journal of Open Learning, New Delhi,* Vol. 2, P73

[7] Jonnasen D H. Beissner K. & Yacci M., Hillsdale, NJ, (1993) '*Structural Knowledge: techniques for representing, conveying and acquiring structural knowledge'* Lawrence Erlbaum Associates.

[8] Kalyuga S. Chandler P. & Sweller J., (1999), Managing spilt attention and redundancy in multimedia instruction, *Applied Cognitive Psychology* 13(4), 351-371

[9] Mayer R. E. & Wittrock M. C., (1996), Handbook of Educational Psychology (New York, Simon & Schuster Macmillan) 47-62

[10] Meltzer, D. E. (2002); 'Active learning Methods. Transforming the lecture hall environment: The fully interactive physics lectures.' *Advance journal for physics,* Vol. 70, No 6, pp 639-354.

[11] Moore M. G. (1989), "Three type of interactions", The American Journal of Distance Education 3(2), 1-6.

[12] Podilefsks, N. S. (2007); 'Analogical scaffolding and the learning of abstract ideas in physics: Empirical studies' *Physics education research,* Vol 3, issue 2, pp 16.

[13] Radford., A., (1997); 'The future of multimedia in education.' First Monday peer review journal on the internet.

[14] Raymond R., Acacio, J., and Suppes., P., (1995); 'Computer based instruction brings advanced placement physics to gifted students.' Computer in physics education. 9(4), 380.

[15] Sweller J., (1989), Cognitive Technology: some procedures for facilitating learning, problem solving in mathematics and science, Journal of Educational Psychology, 81, 457-466.

[16] Wagh, V. G., Matsagar M. B., Gaikwad M. G. (2006), 'Cognitive and Psychomotor Multimedia tool for "PC Hardware Maintenance": A self approach, *The Internation Conference on SCROM 2004*, pp 99-104.

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**Editor's Note**: This study shows how media can be effective in improving the communication skills of students who have some difficulty learning in the face-to-face environment.

# Effect of Computer Mediated Communication on Shy Students' English Speaking Skill

**Malahat Yousefzadeh**
**Iran**

## Abstract

The present paper examines the effect of Computer Mediated Communication (CMC) such as voice chat on improving speaking skills of shy students. This study employed a pretest posttest pre-experimental design with a treatment in which two groups using on-line chat software programs. The result of the study showed that experimental group (shy students) showed an increase in their posttest result when compared with their pretest result.

## Introduction

Somsai and Intaraprasert (2011) said now days, it is undeniable that the communication approach plays an important role in language teaching especially in the context where English is a foreign language and the ultimate goal of language teaching is to improve the communication competence of language learners.

Speaking is the most difficult skill for Iranian students. We hear this sentence more and more " I can't speak English well". Perhaps the students have many knowledge of English grammar and vocabulary, but why they can't speak English? Shyness, inhibition, lack of confidence , losing face and apprehension, these are some of the problems that the English learners have when they want to speak. This faceless environment can be face saving as well, relieving learners of their inhibitions and enabling them to express themselves more freely (Hoffman,1996). According to Friedman (1980), when the ability and desire to participate in discussion are present, but the process of verbalizing is inhibited, shyness or reticence is occurring. Difficulties understanding others and making oneself understood in a FL can result in or be signs of communication apprehension which is defined as a "type of shyness characterized by a fear of or anxiety about communicating with people". (Horwitz et al; 1986, p.127).

Due to the fear of speaking and being too shy to talk, speaking in English is one of challenges of English learners. Ozdener (2008) states that one of the obstacles encountered in improvement of oral skills in the foreign language anxiety resulting from the students' concern about making mistakes particularly in front of their friends. One of the important characteristics of CMC is its secure environment and disinhibition environment. Joinso (1998) defined disinhibition on the internet as "any behavior that is characterized by an apparent reduction in concerns for self presentation and judgment of others" (p.44). Multimodality of the environment allows participation through text and no need to participate in stressful, face-threatening competition for the floor (Cunnigham, Beers Fagersten , & Holmsten, 2010). Hansen (2001) states, unlike traditional face-to- face communication, on line media communication is suggested to be less stressful and more face-saving than face-to-face communication. By reducing social context clues such as gender, race and status, and nonverbal cues such as facial expressions and body language, CMC provides a safer and more relaxed environment for language learners, especially for the shy or less confident ones (Hanson-Smith, 2001; Sproul & Kiesler, 1991)."Chat is a two way form of computer mediated communication, a dialogue in real time as we keyboard or speak our words, an online conversation between two or more people"( Almeida d'Eça 2002 ). According to many studies conducted regarding the use of chat for language learning, chat conversations for one hour a day can improve speaking proficiency to a significant extent (Warschauer, 1996; Chun, 1994).

**RQ**: How can English learners overcome their fears about speaking English if they are shy about it?

## Design

This study employed a one group pretest posttest pre-experimental design.

### *Participant*

40 participants had been studying English as a foreign language for about 8 year. They were at the intermediate level of English proficiency. The participants for the investigation were at two different language institutions in Ardabil. They included 20 students from each institution. They were chosen from two language institutions, because of the anonymity of the environment. They were anonymous and used nicknames. In order to have control and experimental groups, a pretest was given to the participants. 20 of participants were learners whose speaking proficiency level was higher than the others comparing their scores on the basis of pretest. These learners were selected as the control group and the other 20 students were experimental group who were shy and avoid interaction in the class, in order not to lose face. The students in both groups were asked to chat with their partner in the other group.

### *Procedure*

At the beginning of the study, since the students could not be assumed to be at the same proficiency level in English, they were required to take Longman Test (Dawson, 2005). Speaking test was administered in both pretest and posttest included interview, collaborative task and discussion. Total score was 50. The participants answered the questions verbally. Their responses were recorded and then was graded by conversational English Proficiency Rating Checklist. The speaking test took approximately 20 minutes.

Before starting treatment, pretest was administered in order to divided participants into two groups: dominate students(control group) and shy students(experimental group). After pretest , voice chat sessions(treatment) took place for one semester. Treatment sessions took place for one hour daily. Before starting chat sessions topics were determined for discussing. The participants signed in with their nickname. They could consult a dictionary and check grammar rule during chatting.

### *Data analysis*

The data for the present study were obtained through speaking test in pre and posttests.

**Table1**

**Means and standard deviation obtained in pretest**

| | N | Means |
|---|---|---|
| Control group | 20 | 32 |
| Experimental group | 20 | 17 |

**Table 2**

**Means and standard deviation obtained in posttest**

| | N | Means |
|---|---|---|
| Control group | 20 | 36 |
| Experimental group | 20 | 28 |

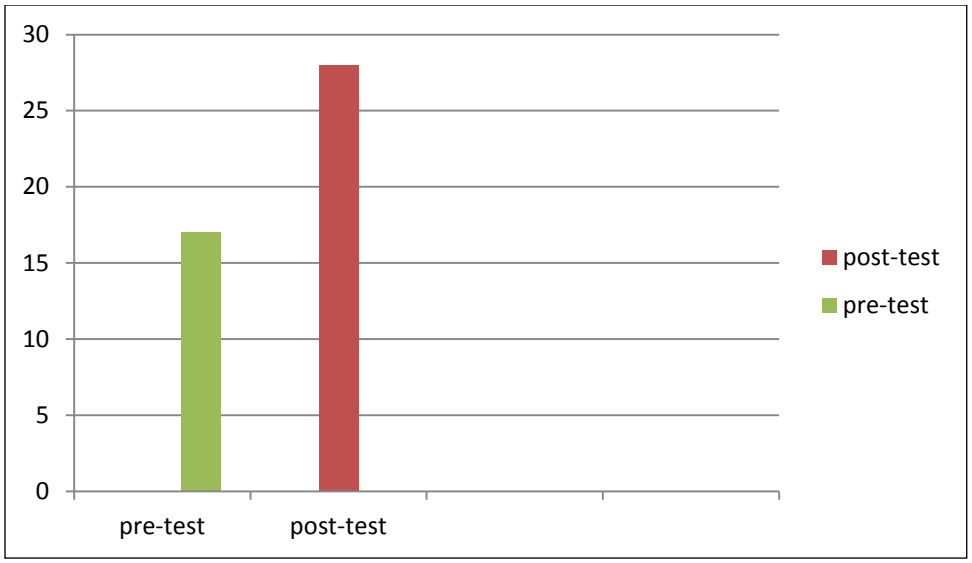


**Figure 1: experimental group's means for pretest and posttest**

As the descriptive statistics in table 1 and 2 indicates the mean of the experimental group on the posttest more than that of the pretest. The T-test analysis shows that the experimental groups had performed well after the treatment. Although the posttest score of control group was higher than their pretest score, the difference between pretest and posttest scores of experimental group was significant than control group.

## Conclusion

Computer mediated communication such as voice chat can be a good experience for shy students and motivates students to take part in speaking . Students benefit from a secure environment to communicate. Integrating of CMC into language learning in addition to improving speaking skill, can promote grammar and vocabulary.

## References

Almeida d'Eça, T. (2002). "*To chat or not to chat in the EFL classroom, that is the question!"* Paper presented at the "Language – Communication – Culture" International Conference, University of Évora, Portugal, on November 29, 2002. Available at http://www.malhatlantica.pt/teresadeca/papers/evora2002/chat-and-efl.htm

Chun, D. (1994). Using computer networking to facilitate the acquisition of interactive competence. *System, 22* (1), 17-31.

Cunningham, U., Beers Fägersten, K., & Holmsten, E. (2010). "Can you hear me, Hanoi?" Compensatory mechanisms employed in synchronous Net-based English language learning. *The International Review of Research in Open and Distance Learning*, *11*(1), 161–177.

Dawson, N. (2005). *New Opportunities Placement Tests*. London: Longman.

Friedman, P. G. (1980) "Shyness and Reticence in Students." Washington, D.C.: *National Education Association*, Stock No. 1675-0-00. ED 181 520.

Hansen, E. A. (2001). *Comparison of Online and Traditional Interaction of Students*. 2001 online conference on teaching online in higher education (TOHE). Retrieved on 03, NOV., 2004 from http://www.Ipfw.edu/as/tohe/2001/papers/hansen.htm

Hanson-Smith, E. (2001). Computer-assisted language learning. In R. Carter & D. Nunan (Eds.), *The Cambridge guide to teaching English to speakers of other languages (pp.107–113*). Cambridge, UK: Cambridge University Press.

Hoffman, R. (1996). Computer networks: Webs of communication for language teaching. In M. Pennington (Ed.), *The power of call* (pp. 55–78). Houston: A Thelstan. Horwitz, E., Horwitz, M., Cope, J. (1986). "Foreign language classroom anxiety."*Modern Language Journal, 70*: 125-132.

Joinson, A. N. (1998). Causes and implications of disinhibited behaviour on the Net. In J. Gackenbach (Ed.), *Psychology and the internet: Intrapersonal, interpersonal, and transpersonal implications* (pp. 43–60). San Diego, CA: Academic Press.

Ozdener, N (2008). Computer-mediated communication in foreign language education: use of target language and learner perceptions, *Turkish Online Journal of Distance Education-TOJDE 9*(2).

Somsai, S. & Intaraprasert, C (2011). Strategies for coping with face to face oral commmunication problems employed by Thai University students majority in English. *GEMA* Online™*Journal of language students 11*(3).

Sproull, L., & Kiesler, S. (1991). *Connections: New ways of working in the networked organizatio*. Cambridge, MA: MIT Press.

Warschauer, M. (1996). Comparing face-to-face and electronic discussion in the second language classroom. *CALICO Journal, 13,* 7-26.

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