Online Discussion Design on Adult Students’ Learning Perceptions and Patterns of Online Interactions

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Abstract: This study examined the impact of the online discussion design on adult students’ perceptions of online learning and their online interaction performance. Specifically, in this causal-comparative study we collected data with surveys and the content analysis of online discussion scripts to explore the learning impact of online discussion types (instructor-led versus student-led), the discussion grouping design (class-wide, group discussions, versus the integrated), and the computer-mediate communication (CMC) environment (asynchronous versus hybrid). The study indicated that the online discussions that were student-led and integrating class-wide and group forums predicted higher learning satisfaction and deeper learning for adult students.

Introduction

Research on higher education has been predominantly based in historical perspectives, beliefs, and curriculum of a traditional student profile – of a person who is 17-24 years old (Kasworm, 1990) living on or near campus. Contemporary online student populations diverge significantly from these student profiles and experiences. Particularly, “most distance education students are adults between the ages of 25 and 50” (Moore & Kearsley, 1996, p.153). These students exhibit significant differences in academic, psychological, and life involvements from traditional students (Richardson & King, 1998; Schlossberg, Lynch, & Chickering, 1989). Corresponding to adult students’ learning profiles, certain online teaching design interventions have been speculated. However, few in-situ studies have been conducted to examine the application of these speculations.

Studies of the designing factors of online discussions that affect adult learning are especially sparse. Recently, learning is conceptualized as a participatory social process where multi-stranded interpersonal transactions mediate the exchange of knowledge (Cole & Engestrom, 1993; Moll & Greenberg, 1990). In such a context, online discussion has become a prominent strategy used in online education to honor the need to learn in socially negotiated spaces (Berge, 1997; Ke & Carr-Chellman, 2006). Thus, online discussions among adult students become an increasingly common and important phenomenon for attention and research.

A recent review of online discussion studies indicated a variety of instructional interventions, including mainly group structure, mentoring and scaffolding, and argumentative instruction (Spatariu, Quinn, & Hartley, 2007). On the one hand, the current state of online discussion research discusses mostly theory but provides little empirical evidence. On the other hand, the research results are based mostly on laboratory experimental studies or surveys, which exclude the authentic context of online learning.

Different from prior research, this study empirically investigates two designing factors of online discussions that have not been well-addressed in empirical studies – discussion types (instructor-led versus student-led) and grouping design (class-wide versus group discussions) in the natural setting of 10 online courses. As Mazzolini and Maddison (2003) questioned, when facilitating online discussions, should online instructors take a prominent ‘sage on the stage’ role to lead online discussions or a more constructivist ‘guide on the side’ role for students to lead the discussions? Although the review of online discussion literature seems to suggest a predominant view of online instructors as more a ‘guide on the side’ or a facilitator (Blignaut, & Trollip, 2003), few empirical studies are available to validate the advantage of student-led online discussions over instructor-led ones.

Similarly, although group size is sometimes discussed in the discussion-based online learning literature, there is relatively little empirical research on this issue. Anecdotal advices exist. For example, Rovai (2002) suggested there should be a trade-off between having enough members to support lively discussions and not having so many participants that people feel overwhelmed. Dooley and Wickersham (2007) expressed concerns that lower level of critical reflection and deep learning would occur in the whole class discussion that in smaller, group discussions. However, more empirical evidence on the relative effects of class-wide discussions versus group discussions needs to be found to back up these advices.

In addition, the current study examines the impact of the computer-mediate communication (CMC) environment, a technological dimension of the online discussion design, on online adult learning. A recent review of the literature indicates that the majority of research on online discussions has been conducted over asynchronous CMC tools; few studies have been done on online discussions in a hybrid (integrating asynchronous and
synchronous communication tools) discussion environment and even fewer research projects have been designed to compare hybrid and asynchronous online discussions. Nevertheless, with the improvement in CMC technology and the availability of affordable synchronous CMC tools (e.g., two-way web conferencing systems), it is critical to conduct research to compare an asynchronous communication environment and a hybrid one in their effects on students’ online learning, especially that of adult students. Due to decreased attentional capacity and working memory, older adults are particularly prone to task disruptions when they are required to perform two or more tasks simultaneously (Sit & Fisk, 1999). Therefore, a communication tool that requires multitasking (such as text-based chat) may create cognitive overload for older adult students. In other terms, a hypothesis is that an asynchronous-only CMC environment should benefit adult students more than the one that integrates synchronous CMC tools. This hypothesis needs to be examined in empirical research.

Online Learning for Adult Students
When reviewing representative adult learning theories, Cercone (2008) synthesized that high-quality online learning for adults need to emphasize self-direction, connecting new knowledge to past experience, and self-reflection – in other terms, deep learning (Majeski & Stover, 2007; Moon, 1999). In agreement with these scholars, this study adopts deep learning theory as a foundation framework that defines successful online learning for adult students. According to Moon (1999), learning as a continuum ranging from the stage of surface learning where the learner simply memorizes new ideas to deep learning where the learner actively integrates new ideas into cognitive structure through learning in a social negotiation environment. Correspondingly, Fink (2003) conceptualized the deep learning to include the major components of integration (connecting ideas), application (applying concepts and skills to an actual problem), and human dimension (learning about oneself and others).

In addition, deep learning for adult students indicated that successful learning should engage the whole person – cognitively, socially, and affectively – in the learning process (Fink, 2003; Garrison, Anderson, & Archer, 2001). Driving from the deep learning theory, interactivity in the class participation and collaborative learning are the two key elements of online learning, critical to student success and satisfaction (Frey & Alman, 2003). Hence adult students’ online interaction performance becomes a key indicator of their cognitive learning outcomes (Garrison, Anderson, & Archer, 2001). Then, according to social constructivists of online learning (Gunawardena, Lowe, & Anderson, 1997; Rovai, 2002), social presence refers to the ability of individuals to project their personal characteristics into the community, thereby developing a sense of community toward their peers in an online course.

Method
In this causal-comparative study, quantitative data was collected with surveys and the content analysis of students’ online discussions throughout a regular school semester. We conducted inferential statistics to predict causal-effect relationships between the online discussion design (comprising the discussion type, the grouping design, the computer-mediated communication (CMC) environment) and online students’ perceptions and performance.

Courses and Participants
Fifty one students, majored in nursing, business management, and education were recruited from 10 web-based courses (three are undergraduate-level and seven graduate-level) in an American research university. These courses had the following features: 1) all courses were offered purely online using WebCT course management system; 2) adult students were the majority in every course; 3) all courses were taught by experienced instructors (with averagely 5 years’ online instruction experience); 4) five of the ten online courses employed hybrid CMC tools (threaded discussion forum, chat room and/or Live Classroom web conferencing system) to support online interaction activities while the other five only used threaded discussion forum; 5) the ten courses differed in their online discussion types and grouping: Five courses’ online discussion types were classified as student-led and five as instructor-led based on the course instructors’ self-report and an expert review of online discussions1. Five courses had only class-wide discussions, three had only group discussions, whereas the other two had both.

In this study, adult students are defined as a student who is older than 25, returning to or re-entering their post secondary education and enrolling on less than a full-time basis. Participating students’ demographic data, including age, gender, ethnic status, and perceived technology competence level, was collected prior to the study. The participants were diverse in their educational levels: 16% undergraduate, 58% master students, and 26% doctoral students. The age range of the participants was 24-59, with 43 as the mean, 22% younger (24-29), 48%

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1 In an instructor-led discussion forum, the instructor typically lead every discussion thread and the discussion posts under each thread comprise mostly instructor-student discourses rather than student-to-student peer discussions.
mature (30-49), and 30% older (50 and above). 28% of the participants were minority (Hispanic and Asian), 85% were female, and 14% rated their confidence level as “basic” or “below basic” in the use of technology to complete coursework. And there was no significant correlation between students’ age and their confidence level in using technology for online learning.

Data Collection

Procedure
The examination of participant’s online interaction performance was conducted through a content analysis of archived online interaction transcripts (i.e., threaded online discussion posts). Online interaction transcripts throughout the whole school semester were archived. For the reported study, averagely six weeks’ online interaction transcripts were gathered and coded for each course (two at the second and third school week, two at the mid-term, and the other two at the end of the school term).

At the end of the school session, three quantitative surveys were distributed to all participants to measure their learning satisfaction and attitudes toward learning environment, self-perceived online learning stages (Deep vs. Surface learning), and perceived level of sense of community in online courses (Rovai, 2002).

Instruments

Learning Experience Survey: This 10-item survey was self-developed by the researchers of the present study based on the standard online course evaluation surveys used by the distance education departments of two major American research universities. The survey includes five six-point Likert-scaled items on students’ satisfaction level with online learning and instruction (reliability Alpha = .90), and five open-ended items on students’ time spent on online courses.

The Classroom Community Scale (Rovai, 2002) is an instrument to assess students’ sense of community and the extent of community development within a course. Rovai (2002) defines sense of community as consisting of two components: feelings of connectedness among community members and commonality of learning expectations and goals. The CCS contains 20 Likert-scaled items, ten items each for the subscales of connectedness and learning. Rovai (2002) has field-tested the CCS with university graduate students enrolled in e-learning courses, reported a high internal consistency of the total scale. Since its publication the CCS has been cited or applied in quite a few learning community studies (e.g. Anderson, 2004; Blignaut & Trollip, 2003; Brook & Oliver, 2003). The reliability for the CCS in this study was .93.

The Study Process Questionnaire (Biggs, Kember, & Leung, 2001) is a 20-item Likert-scaled survey used to determine participants’ self-perceived learning stages or approaches in two dimensions – Deep Approach (DA) and Surface Approach (SA). Each dimension was measured by 10 items. The reliabilities for these two latent dimensions/factors were 0.82 and 0.86 respectively. In this study, students’ scores in DA dimension and SA dimension were used as two continuous variables representing their self-perceived level of deep learning and surface learning respectively.

Online Learning Interaction Coding Scheme: In order to evaluate the objective evidence for adult students’ cognitive and social engagement, the authors of this study conducted content analysis with archived online interaction transcripts. In agreement with Beers, Boshuizen, Kirschner, and Gijselaers (2007), the authors of this study held the belief that a new online collaborative learning research project, when focusing on a different theoretical framework or a different research purpose, will generally require new coding themes for analysis. Therefore, rather than using an existing content coding themes, we analyzed the online interaction transcripts using a self-developed analysis schemes - Online Learning Interaction Model (Table 1).
Table 1: Online Learning Interaction Model

<table>
<thead>
<tr>
<th>Code</th>
<th>Category</th>
<th>Definition</th>
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<tbody>
<tr>
<td>S</td>
<td>Social Interaction</td>
<td>Having the indicators of greetings, comments without elaboration (e.g., “I agree with you”), personal life, and emotional expressions.</td>
</tr>
<tr>
<td>K1</td>
<td>Sharing information</td>
<td>Simply adding facts, opinions, or questions without elaboration</td>
</tr>
<tr>
<td>K2</td>
<td>Egocentric elaboration</td>
<td>Elaborating one’s own arguments/concepts/problem solutions</td>
</tr>
<tr>
<td>K3</td>
<td>Allocentric elaboration</td>
<td>Comparing and synthesizing peers’ multiple perspectives</td>
</tr>
<tr>
<td>K4</td>
<td>Application</td>
<td>Planning future application of new knowledge or proposing in-field application strategies; developing new perspectives</td>
</tr>
<tr>
<td>R1</td>
<td>Coordination</td>
<td>Teamwork planning and coordinating for collaborative projects</td>
</tr>
<tr>
<td>R2</td>
<td>Reflection</td>
<td>Self-evaluation and self-regulation on learning process</td>
</tr>
<tr>
<td>R3</td>
<td>Technical issues</td>
<td>Questioning and answering on technological problems or assignment clarification</td>
</tr>
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This model was developed based on the theoretical framework of deep learning (Cercone, 2008; Fink, 2003; Moon, 1999) and a synthesis of the two representative content analysis schemes in the distance education literature: Henri’s work (1992) that examined the quality of online postings based on cognitive information processing model, and the framework of Gunawardena, Lowe, and Anderson (1997) that examined evidence of knowledge building in online forums from a social constructivism paradigm. The current model holds the social constructivist view of learning but also keeps students’ cognitive perspective in consideration.

In this model, the unit of analysis was “thematic unit” (Henri, 1992). Each unit was classified into one of the eight analytic categories under three dimensions, as outlined in Table 1. This coding framework highlights a knowledge construction process that ranges from the stage of surface, individualistic learning (K1) gradually (K2 as transition) to deep, collaborative learning (K3 and K4) where the learner actively synthesizes and integrates new ideas and then turns new knowledge into applications. It also addresses social interactions (S) and self-regulated or self-directed processes that comprise learning-oriented self-reflection (R2), teamwork coordination (R1), and technical issues management (R3).

Two raters coded the online interaction transcripts. After reaching 100 percent agreement on scoring two sample weeks’ transcripts, both raters double-blindly scored the rest transcripts. The inter-rater reliability is .87. The two raters also discussed the differences in their codes and reached an agreement at 100%. The final revised codes were used for analyses.

Analysis
With quantified data on students’ involvement with different categories of online learning interactions, as well as the results of the surveys, the researchers then conducted inferential statistics to predict causal-effect relationships between online discussion contexts and online students’ perceptions and performance.

Findings
Effects of Discussion Types on Learning Perceptions
An ANCOVA test was conducted to investigate the effect of discussion types (student-to-student, n=26; student-to-instructor, n=19) on students’ satisfaction with the online course. The assumptions for ANCOVA were met. The test was significant, $F (1,41) = 5.08, p < .05$ [effect size (partial $\eta^2$) = 0.11]. The mean satisfaction rating adjusted for age difference was different across the two online discussion types. The adjusted mean of the student-led discussion type ($M = 27.18$) was significantly higher than that of the instructor-led discussion type ($M = 23.65$).

Another ANCOVA test was conducted to investigate the effect of discussion types on students’ scores in the classroom community scale, with the effect of age difference removed. The assumptions for ANCOVA were met. The test was almost significant, $F (1,42) = 3.77, p = .06$, indicating a potential difference between the two discussion types in promoting students’ sense of community. Student-led interactions ($M = 92.22$) seemed to create higher sense of community score than instructor-led interactions ($M = 80.17$) did.
A MANCOVA test was conducted to investigate the effect of discussion types on students’ scores of the deep approach subscale and scores of the surface approach subscale. The test was not significant. There was no enough evidence suggesting that by removing the effect of age, there was significant difference between two discussion types in reinforcing students’ self-reported degree of deep or surface learning.

**Effects of Discussion Types on Interaction Performance**

An ANCOVA test was conducted to investigate the effect of discussion types (student-to-student, n=26; student-to-instructor, n=19) on the quantity of social interactions, by removing the effect of age difference. The assumptions for ANCOVA were met. The test was significant, F (1,41) = 5.14, p < .05 [effect size (partial η2) = 0.11]. The mean social interaction quantity adjusted for age difference was different across the two online discussion types. The adjusted mean of the student-led discussion type (M = 9.72) was significantly higher than that of the instructor-led discussion type (M = 2.10).

The ANCOVA test on the effect of online discussion type on the total amount of knowledge-constructive interactions was not significant. However, the MANCOVA test examining the effect of discussion type on the two higher-level, collaborative knowledge-constructive interactions (K3 and K4) was significant, F (2,40) = 6.54, p < .01, [effect size (partial η2)=0.25]. Examination of univariate results showed that significant discussion type differences occurred on both K3 interactions [F (1,41) = 6.48, p < .05] and K4 interactions [F (1,41) = 9.52, p < .01]. The adjusted mean for K3 interactions of the student-led discussion (M = 5.39) was significant higher than that of the instructor-led discussion (M = 1.45). Then, the adjusted mean for K4 interactions of the student-led discussion (M = .61) was still significant higher than that of the instructor-led discussion (M = .01). But in the MANCOVA test, the assumption on the variance homogeneity across the groups was rejected. Therefore, two Kruskal-Wallis tests were conducted to re-investigate the influence of online discussion types on K3 and K4 interactions. The tests were still significant: for K3, H=15.4, 1 d.f, P=0.000; for K4, H=8.58, 1 d.f, P=0.003.

An ANCOVA test was conducted to investigate the effect of online discussion type on the total amount of learning-regulation interactions (sum of R1, R2, and R3), with the effect of age removed. The test was not significant. However, the ANCOVA test examining the effect of discussion types on the amount of reflection-oriented learning-management interactions (R2) was significant, F (1,41) = 3.84, p < .05 [effect size (partial η2)=0.09]. The adjusted mean of the student-led discussion type (M = 1.02) was significantly higher than that of the instructor-led discussion type (M = 0.01). But it should be noted that the effect size is small.

**Effects of Grouping Design on Learning Perceptions**

An ANCOVA test was conducted to investigate the effect of discussion grouping (group discussion, n=18; class-wide discussion, n=18; and the integrated of the two, n=9) on students’ satisfaction with the online course, by removing the effect of age difference. The assumptions for ANCOVA were met. The test was significant, F (2,40) = 4.17, p < .05 [effect size (partial η2)=0.17]. The adjusted mean of the class discussion (M = 23.06) was significantly lower than that of the group discussion (M = 27.79) and that of the integrated discussion (M = 26.83).

An ANCOVA test was conducted to investigate the effect of discussion grouping on students’ sense of community, by removing the effect of age difference. The test was not significant. However, a pair-wise comparison between group discussion and class discussion was significant (p < .05), indicating a potential difference between the two participation units in promoting students’ sense of community. Group discussion (M = 93.57) seemed to create higher sense of community score than class discussion (M = 79.50) did.

A MANCOVA was conducted to investigate the effect of discussion grouping on students’ scores of the deep approach subscale and the scores of the surface approach subscale. The test was not significant. There was no enough evidence suggesting that by removing the effect of age, there was significant effect of the discussion grouping in reinforcing students’ self-reported degree of deep or surface learning.

**Effects of Grouping Design on Interaction Performance**

An ANCOVA test was conducted to investigate the effect of discussion grouping (group discussion, n=18; class-wide discussion, n=18; and the integrated of the two, n=9) on the quantity of social interactions, by removing the effect of age difference. The assumptions for ANCOVA were met. The test was significant, F (2,40) = 10.16, p < .01 [effect size (partial η2)=0.34]. The adjusted mean of the integrated discussion (M = 16.96) was significantly higher than that of the group discussion (M = 7.17) and that of the class-wide discussion (M = .51); then the adjusted mean of the group discussion is significantly higher than that of the class discussion.

An ANCOVA test was conducted to examine the effect of discussion grouping on the total amount of knowledge-constructive interactions (sum of K1, K2, K3 and K4), by removing the effect of age difference. The test was not significant, indicating a lack of evidence for the effect of the discussion-participation units on the overall
quantity of knowledge-constructive interactions. The further tests on the effect of discussion grouping on the individual types of knowledge-constructive interactions were not significant either.

An ANCOVA test was conducted to investigate the effect of discussion grouping on the total amount of learning-regulation interactions (sum of R1, R2, and R3), by removing the effect of age difference. The test was significant, $F(2,40) = 6.22, p < .01$, [effect size (partial $\eta^2$)=0.24]. Pairwise comparisons indicated that the adjusted mean of the integrated discussion ($M = 14.01$) was significantly higher than that of the group discussion ($M = 6.30$) and that of the class-wide discussion ($M = 1.28$). However, the assumption on the variance homogeneity across the groups in the ANCOVA test was rejected. Therefore, a Kruskal-Wallis test was conducted to re-investigate the influence of discussion grouping on the total amount of learning-regulation interactions. The test was still significant: $H=6.55, 2$ d.f, $P=.04$.

Then, an ANCOVA test was conducted to investigate the effect of discussion grouping on the amount of interactions for planning/coordination (R1), by removing the effect of age difference. The assumptions for ANCOVA were met. The test was significant, $F(2,40) = 9.05, p < .01$ [effect size (partial $\eta^2$)=0.31]. The adjusted mean of the integrated discussion ($M = 10.77$) was significantly higher than that of the group discussion ($M = 4.36$) and the class-wide discussion ($M = 0.59$). The adjusted mean of the group discussion then was significantly higher than that of the class discussion. However, the assumption on the variance homogeneity across the groups in the ANCOVA test was rejected. A Kruskal-Wallis test was conducted to re-investigate the influence of discussion-participation units on the overall quality of learning-management interactions. The test was still significant: $H=14.02, 2$ d.f, $P=.001$. The ANCOVA tests on the effect of discussion grouping on the amount of the other two learning management interactions (R2 and R3) were not significant.

**Effects of CMC Environments on Learning Perceptions**

Three analyses of covariance were conducted to investigate the impact of the CMC environment on students’ perception of learning. The independent variable, the CMC environment, involved two levels: asynchronous only (n=22) and hybrid (integrating asynchronous and synchronous communication tools, n=23). The dependent variables include students’ course satisfaction level, the score of sense of community scale, the score of the deep approach subscale and the score of the surface approach subscale in the learning process questionnaire. The age was used as the covariate. None of the analyses was significant. Therefore, there was no enough evidence suggesting that by removing the effect of age, there was significant difference between two CMC environments in reinforcing students’ satisfaction level, sense of community within online courses, or self-reported degree of deep or surface learning approach.

**Effects of CMC Environments on Interaction Performance**

Three ANCOVA (with age as the covariate) was conducted to investigate the effect of the CMC environment on the amount of social interactions performed, on the total amount of knowledge-constructive interactions performed, and on the total amount of learning-regulation interactions performed. None of the three ANCOVA was significant.

However, a MANCOVA test indicated that by removing the effect of age difference, there was a significant difference between asynchronous-only courses and hybrid courses in the adjusted means of two knowledge-constructive interactions (K1 and K2), $F(2,40) = 4.19, p < .05$, [effect size (partial $\eta^2$)=0.17]. Examination of univariate results showed that significant course model differences occurred on the amount of K1 interaction only, $F(1,41) = 5.33, p < .05$. The adjusted mean of the asynchronous-only courses ($M = 27.43$, n=22) was significant higher than that of hybrid courses ($M = 10.92$, n=23).

The MANCOVA test (with age as covariate) on the effects of communication technology application on the two higher-level knowledge-constructive interactions (K3 and K4) was not significant. Similarly, there was no significant effect of communication application on the interactions for teamwork planning/coordinateing (R1), reflection (R2), or technical issues (R3).

**Discussions**

The study results indicated that student-to-student discussions, in comparison with student-to-instructor ones, predicted higher satisfaction, more social interactions, more high-level knowledge-constructive interactions, more reflection-oriented interactions, and potentially stronger sense of community. This pattern confirms the suggestion of prior research that student contributions in online discussions may increase when the discussions are not instructor led (Cifuentes, Murphy, Segur, & Kodali, 1997; Rovai, 2007) and that more peer interaction results in higher learning outcomes (Moller, Harvey, Downs, & Godshalk, 2000). As Dennen and Wieland (2008) reported, when students were involved in monologic posts that were oriented toward the instructor, there was less peer-interaction among learners, hence less social interaction or collaborative knowledge construction. In addition, it was
observed that the instructors, as the single interactee for all students, seemed to be overwhelmed by the volume of
the posts and were not able to provide responses to all messages, hence not creating a discussion environment that
promotes deep learning through interactive learning dialogues.

Finally, it was found that group discussions, in comparison with class-wide discussions, predicted higher
satisfaction level and stronger sense of community among adult students. This finding did not support the finding of
Bullen (1998) that students appreciated the whole-class discussion because of the “many-to-many” communication
options it offers. However, it addressed the qualitative notes of Dooley and Wickersham (2007) that the whole class
discussion created the discussion threads that were overwhelming in number and made individuals become lost, be
distracted, and lose equal opportunity to voice their opinions and thoughts and demonstrate their understanding to
their peers and instructor. On the other hand, although Dooley and Wickersham (2007) expressed concern that lower
level of critical reflection and deep learning would occur in the whole class discussion that in smaller, group
discussions, their concern was not supported in this study. There was no enough evidence suggesting that adult
students in class-wide discussions, in comparison with those in group discussions, demonstrated different levels of
performance in knowledge-constructive interactions or reflective interactions.

Actually, the study results suggested that adult students in the online courses that integrated class-wide and
group discussions perform most social interactions and learning-regulation interactions. An interpretation is that an
integrated online discussion environment enables adult students to access multiple ideas and opinions in the class
forum and at the same time provide them a group forum where they can remain focused and better manage the
discussion threads.

The study did not indicate any added or compromised value by using synchronous communication tools in
online courses for adult students. Prior research suggested that synchronous communication may improve social
presence and social interactions but sacrifice the topic-related discussions (Im & Lee, 2004). Such a suggestion was
not confirmed in the study since there was no significant difference between asynchronous communication
environment and the integrated one in predicting emotional sense of community, learning satisfaction, or general
online interaction performance. On the other hand, this finding supports the conclusion of Cleveland-Innes and Ally
(2004) that there was no significant difference between synchronous and asynchronous communication tools in
reinforcing learning outcomes for adult continuing education. However, there is a potential trend that interactions for
the first level knowledge-constructive interaction - information sharing in discussion forums – may be reduced in an
integrated communication environment. A possible reason may be that part of interactions for information-sharing
was released from the discussion forums to the synchronous communication environments (text chat-room or
computer conferencing) that enable timely and verbal exchange of fact and information. A potential consequence of
such a pattern is that adult students may concentrate their efforts in deep learning interactions (i.e., K3, K4, or R2) in
online discussion forums. However, this proposition was not supported by the study since adult students in the
integrated communication environment did not demonstrate better performance with deep learning interactions. It is
possible that the “floor effect” – generally very low participation in K3, K4, or R2 discussion types – has made it
difficult to detect the difference between the two communication environments. It is recommended to conduct
further research with a bigger participant pool to investigate the difference between the two communication
environments.

Significance of the Research
The study is an initial attempt to explore learning environment pedagogies that positively impact adult students in
online contexts. It is an important complement to the existing literature on e-learning instructional design, adult
education, and cognitive aging. Practically, the findings inform educationalists how to design online discussions for
adult students as they create successful distance education programs.

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