# STUDIES COURSE: COLLECTIVE EFFICACY, SELF-REGULATORY EFFICACY, FLOW, AND EXTENDED TAM PERSPECTIVE

**Man-Ki Moon**
The Graduate School of Advanced Imaging Science, Multimedia & Film,
Chung-Ang University, Seoul South Korea
moon1915@empas.com

**Ki-Duk Kim**
Konkuk University,
Department of Digital Cultural & Contents,
neutro@konkuk.ac.kr

**Sun-Young Park**
KonKuk University,
School of Business,
Department of Management of Technology
sunpark.korea@gmail.com

**ABSTRACT**

This study was conducted as a case study of a collective composition learning model (CCLM) based on computer assisted collaborative learning framework which was attempted in a university liberal arts convergence studies course in South Korea. CCLM is considered to be an important learning model in the realm of education technology. Accordingly, many educators are currently proposing various research models related to the CCLM based on computer assisted collaborative learning. Although convergence studies curriculum and correlated or relevant curriculum can be learned recently at universities in Korea which regard it as a very important discipline to the extent that it is classified as a learning model, there are still challenges to maximizing learning effect due to characteristics of science and engineering, liberal arts and heterogeneous group courses. In order to solve this problem, we produced the CCLM based on web and applied this to courses. While taking characteristics of each team into consideration, the researchers applied Jigsaw II model and proposed a level of difficulty and learning topics to each team. According to the results of an extended TAM model application measured after one semester was completed, web based CCLM had a positive effect on heterogeneous learning groups. These results show that web based CCLM can be applied effectively to both university education and various forms of heterogeneous group learning model.

## Keywords

Heterogeneous group learning, Collective composition model, Collective efficacy, Self-regulatory efficacy, Flow, Technology acceptance model

## Introduction

Arguably, many studies have emphasized the importance of collaborative learning in that it is a very effective approach to the promotion or development of self-efficacy, learning motivation, positive learning attitude, comradeship or interpersonal relations, sociality of learners, etc. (Cohen, 1994; Flower & Hayes, 1981; Isman & Celikli, 2009; Jonassen, 2006; Johnson & Johnson, 1992; Moon et al., 2011; Vygotsky, 2007; Webb & Palincsar,1996). Furthermore, recent computer-assisted collaborative learning model provides more effective learning environment for promoting collective efficacy of learners (Wang & Lin, 2007 Wang, 2008).

Most strategies of collaborative learning are designed to help learners accomplish learning objectives and develop communication skills or academic thinking ability by sharing individual strengths and collaborating among learners within a group (Wang & Lin, 2007). Accordingly, collective learning enables most learners to do learning successfully by sharing varied abilities of individual learners, as opposed to learning models based on competition which exclude a lot of students from an opportunity for success and preclude them from utilizing their individual strengths (Cohen, 1994; Johnson & Johnson, 1992; Mevarech, 1999). In other words, learners experience significant intrinsic motivation effect through collective learning, which in turn contributes to the promotion of self-efficacy and collective efficacy.

In this respect, collective composition learning model (CCLM) is recently classified as a crucial component of computer–assisted collaborative emergent learning (Moberly, 2008). Many scholars have also stressed that CCLM can help learners develop or foster future oriented attitude, cognitive strategy, critical thinking ability, socialization and learning attitude (Gibson et al, 2000; Gibson, 2001; Wang & Lin, 2007).

Generally, courses like 'critical thinking' and 'discussion' based on CCLM are designed to cultivate ability of speaking logically through critical thinking and to improve writing ability by making learners write their views about discussion issues. Johnson & Johnson (1992) pointed out that collective composition learning enables learners set up learning objectives initiatively and contains intrinsic motivational components leading to proper learning behavior.

Most learning based on CCLM includes learning content associated with courses like 'academic writing', 'critical thinking and discussion', 'creative thinking and expression', etc. 'Academic writing' is a course designed so that students can develop ability to write an academic thesis or research paper (report) by attempting logical and critical writings (Wang & Lin , 2007).

Furthermore, Flower & Hayes (1981), Carl & Marlene (1987), etc. are recognized as leading researchers who attempted the modeling of cognitive phenomena taking place in a process of writing from a perspective of cognitive psychology. The most noticeable characteristic of Flower and Hayes Model lies in the emphasis on processes of 'planning', 'writing' and 'reviewing' as an important element for problem solving and the setting of 'reflection' element which control each process (Flower & Hayes, 1981; Flower, 1990; Hayes, 1996). What distinguishes this model from others is the setting of 'reflection' process.

Especially, Hayes (1996) suggested 'problem solving model reflecting social perspective'. What Hayes Model is different from Flower Model is as follows: First, Hayes assumed two axes called 'individual factor and environment factor' and emphasized that writing is interaction between an individual and environment. Second, Hayes went on to spotlight social perspective of writing by specifying task environment into social environment and physical factors. Third, Hayes specified interaction factors taking place inside an individual. In other words, this work includes visual and spatial factors as well as linguistic representation, and considers motivation and affective factor as important. Accordingly, what is important in instructing CCLM based courses is to help students maintain logical consistency in their writings by being looked over and corrected through open correction system or individual guidance of an instructor.

In recent years, various forms of CCLM are studied in relation with distance learning (Cohen 1994; Johnson & Johnson, 1992; Juul, 2002; Moberly, 2008). For example, there are creative models including CCLM based digital games, web based CCLM and interactive collective composition learning model related to emergent learning. Most of these models stress the importance of cognitive strategy, socialization and learning attitude, and interaction between an individual and the society on the basis of motivation learning using digital environment (Moon

et al., 2011). In this regard, this study focused on a method of solving heterogeneous group learning problems through group learning rather than a method of learning writing skills.

Besides, this study introduces important studies on homogeneous group learning model. Wang & Lin (2007) emphasized that CCLM is a more effective learning model for heterogeneous group than for homogeneous group. Especially, Wang & Lin stated that students from heterogeneous group tend to think in a more elaborative way and to make greater efforts to overcome differences of opinion with other students compared to students from other groups. In other words, they mean that heterogeneous group members make good use of many different perspectives as learning background, which in turn contributes to developing their learning ability.

This study has a meaning in that it applied heterogeneous group learning model to real convergence studies courses at university in an effort of improving learning effects. Liberal arts courses at a level of convergence studies being recently introduced in Korea have positive aspects of helping students realize interdisciplinary connectivity and learn correlated curriculum and relevant curriculum. However, these courses still have difficulties to be overcome in a process of maximizing collective learning effect since students participating in these courses form heterogeneous groups whose members major in different disciplines. Through CCLM applied to resolve this problem, the researchers attempted to raise learning effects with the promotion of self-efficacy and collective efficacy of learners.

## Theoretical background and the research model

### Collective Efficacy

Collective efficacy, an extended concept of self-efficacy, involves group performance (Bandura, 1986, 1997). This concept is also used as an important component in the field of education as well as social psychology. Increased collective efficacy in collaborative learning environment plays a positive role in promoting self-efficacy of individual learners, strengthening group competency and improving past team performance (Bandura, 1986, 1997, 2000; Gibson et al., 2000). In other words, groups with a high level of collective efficacy also show a high level of self-efficacy (Wang & Lin, 2007).

According to social cognitive theory (Bandura, 1986), collective efficacy is subdivided into level of effort, persistence, and achievement. Self-efficacy more sophisticated through collective efficacy is defined as 'judgment' and 'confidence' about one's ability to perform a certain activity successfully (Bandura, 1986, 1997). Generally, people with a high level of self-efficacy typically have a tendency to involve themselves in or commit themselves to difficulties with which they are faced (Bandura, 1986; 1997; Yi & Hwang, 2003). Besides, many studies show experimentally that self-efficacy with motivation effect plays a positive role in making a learner continue his or her learning behavior (Lent et al., 2006). This behavior of a learner can be effectively applied to CCLM environment (Wang & Lin, 2007).

Especially, Wang and Lin (2007) stressed that self-efficacy and collective efficacy is major factors for successful learning accomplishment in relation with research on computer-supported collective composition model. He classified motivational components having a significant effect on learning achievement of a learner into 'an expectancy component', 'a value component' and 'an affective component': 'an expectancy component' means self-efficacy relevant to expectation about the achievement of learning objectives of a learner; 'a value component' is a

task value relevant to the degree of perceiving the usefulness of learning objectives; and 'an affective component' indicates a will to accomplish a goal (Pintrich & Schunk, 2002; Wang & Lin, 2007).

Particularly, self-efficacy, students' perceptions of their capability to reach a desired outcome, is most powerful in predicting academic performance than other motivational beliefs (Lent et al., 2006; Printrich & Schunk, 2002; Wang & Lin, 2007).

Igbaria and Iivary (1995), who applied efficacy theory to TAM Model, suggested that Perceived Ease of Use has a positive effect on self-efficacy. This means that usability of specific artifacts has a significant effect on self-efficacy of people. Besides, Agarwal and Karahanna (2000) suggested through experiment that self-efficacy has a positive effect on Perceived Usefulness as well as Perceived Ease of Use. In this regard, this study measured the significance and effect of collective efficacy variables based on extended TAM. Besides, hypotheses about collective efficacy components presented by this study were organized on the basis of Bandura (1986, 1997,2000); Wang and Lin (2007).

H1 is based on an assumption that the increase of collective efficacy will affect self-regulatory efficacy in CCLM environment. H2 is a hypothesis about Flow, and H3 is a hypothesis about Perceived Ease of Use.

H1: Collective efficacy will have a positive effect on Self-regulatory efficacy of CCLM.
H2: Collective efficacy will have a positive effect on Flow of CCLM.
H3: Collective efficacy will have a positive effect on Perceived Ease of Use of CCLM.


**Self-regulatory efficacy**

The aforementioned studies indicate that self-efficacy is strongly related to student learning behaviors (Lent et al., 2008). According to social cognitive theory (Bandura, 1986, 1997), self-efficacy is defined as "judgment about one's ability to conduct and organize behavior needed to create a certain kind of outcome or performance" selectively using behavioral, cognitive and emotional resources necessary for successful performance. As a factor affecting achievement, self-efficacy is maximized mostly by self-regulation (Bandura, 2000). This is no exception in learning environment, too. A lot of research on self-efficacy as a major variable was conducted in scenes of education or training. Prior to education or training, self-efficacy is associated with education or training performance and openness toward what is new; whereas self-efficacy after education or training is associated with transference of training (e.g., practical use of newly learned knowledge and kills) (Gist, 1987). What a learner learns through direct or indirect experience in learning environment includes performance standards, which are basic to self-evaluation. For example, when the performance of a learner satisfies or exceeds his or her standards, it deserves positive evaluation, whereas when it falls short of standards, it receives negative evaluation.

Accordingly, people sure of self-efficacy handle a task more actively and aggressively in a certain situation, spends a lot of effort and time on a specific work consistently, set up higher standards regarding behavior to be performed, and commit themselves to accomplish it (Bandura, 1990; Latham & Locke, 1991).
Bandura (1986) and Salomon (1984) found through experimental study that people with high level of self-efficacy spent a large amount of cognitive effort on a task which others think difficult and showed a large amount of learning, but they spent a small amount of cognitive

effort on a task which others think easy and showed a small amount of learning (Bandura, 1986; Salomon, 1984). In this regard, self-efficacy is related to goal-setting and achievement of a person. In other words, people with high level of self-efficacy set a more challenging goal, spend more effort and time to achieve the goal, and are committed to the goal more persistently compared to people with low level of self-efficacy (Bandura, 1982; Latham & Locke, 1991). With regard to self-efficacy, many scholars divide it into general self-efficacy and specific self-efficacy (Bandura, 1982; Latham & Locke, 1991).

General self-efficacy and specific self-efficacy are both beliefs about one's ability to achieve desired outcome, and are basically the same in concept. They are also similar in that general self-efficacy is strongly influenced by experience of success and failure accumulated in the past. They are different merely in performance areas with which both concepts are concerned. General self-efficacy construct has the following important aspects: First, general self-efficacy goes beyond situations and tasks, and predicts specific self-efficacy. That is, general self-efficacy has an effect on specific self-efficacy through specific situations or spill-over effect into a task. Second, specific self-efficacy predicts the performance of relevant local task or in local situations, whereas general self-efficacy predicts the comprehensive performance of general task or in general situations. Finally, general self-efficacy serves to buffer effects of debilitating specific self-efficacy after adverse experience (Bandura, 1986, 1997; Chen et al., 2001).

According to cognitive psychology theory, self-regulatory is the efficacy of well performed self-regulatory mechanism such as self-observation, self-judgment and self-response (Bandura, 1986, 1997). Especially, self-observation is a process of watching and observing his or her behavior or outcomes while a learner is performing to accomplish a goal. Through this process, a learner reflects his or her ability. Self-regulatory learning is a learner's intended efforts for learning subjects (Corno & Mandinach, 1983; Seo & Lies, 2009). In other words, it is a systematic management process regarding one's own thoughts, emotions and behavior for one's personal goals and achievements (Bong, 1997; Lee & Lee, 2008). Accordingly, the learner uses the strategic relationship between self-regulation and learning to reach his chosen self-learning goal, and to develop, revise, and complement the learning strategy via self-feedback (Chen, et al., 2001; Lee & Lee, 2008).

Accordingly, the learner must make constant efforts to sustain learning motivation (Lee & Lee, 2008; Zimmerman, 1990). From this perspective, it is important that learning environment must provide self-regulatory components to maximize learning effects.

H4 and H5 construct a hypothesis to measure the effect of self-regulatory efficacy on Perceived Ease of Use and Behavioral Intention.

H4: Self-regulatory efficacy will have a positive effect on Perceived Ease of Use of CCLM.

H5: Self-regulatory efficacy will have a positive effect on Behavioral Intention to use the CCM.

**Flow**

Flow Theory has been attracting attention of many educationalists since a study of Csikszantmihalyi was published in 1975 (Finneran & Zhang,2003; Jonassen,2006; Moon et al., 2011;Prensky,2001).

Flow model invented by Csikszantmihalyi is a model to clarify specific effects of Skills and Challenge on player in that Skills and Challenge are essential components when man engages in play of his own accord and gets immersed in it. Flow model sets Skills on the x-axis and Challenge on the y-axis; and explains through which process a player reaches Flow Zone, an optimal situation, performs a task while playing, and in which section Skills and Challenge keep a balance (Csikszantmihalyi, 1975; Moon et al, 2011). Thus, Flow theory is widely used in areas of experience learning, complex concept and multiple dimensions (Lu et al., 2009).

Besides, Ghani (1995) stated that a parameter in a process of reaching Flow is enjoyment and concentration, while explaining intrinsic motivation. He is considered to have believed that enjoyment and concentration is a parameter which induces concentration while man is performing specific behavior.

Furthermore, the theory of Ghani (1995) is a comprehensive study, whereas Yi et al. (2003) explained flow constructs based on 4 variances including control, attention focus, curiosity, and intrinsic interest. This study suggested that there is a close relationship between Flow and intrinsic motivation associated with the maximization of durability and efficiency while man is performing specific behavior. 4 variances suggested by Yi et al. (2003) refer to respective phases of reaching Flow, which can be effectively applied to experience learning model.

The introduction of Flow theory to education models is an approach for realizing learner-centered meaningful learning effectively, which is widely attempted in relation with active research on education using digital media (Moon et al., 2011). In particular, many scholars, who began to pay attention to the possibility of Problem-Based Learning through experience learning model based on digital games which enable anyone to participate in learning actively since childhood through 'Amusement' element of 'play' in Virtual World and provide optimal conditions for reaching Experiential Learning, are studying this approach systematically (Moon et al., 2011; Prensky, 2001).

The following H6 and H7 construct a hypothesis employed by this study based on previous studies on Flow theory. Many researchers, who applied Flow theory to Extended TAM, suggested that Flow is maximized by Self-efficacy and Perceived Ease of Use, and has a positive effect on Perceived Usefulness and Behavioral Intention (Yi & Hwang, 2003; Li & Brown, 2006; Lu et al., 2009; Moon et al., 2011). Specially, most web-based learning models similar to this study suggested that free real-time interaction between learners based on expectation of remedying their shortcomings through peer learning, spontaneous correction activities and computer application ability is a factor of increasing Flow (Prensky, 2001).

H6 and H7 construct a hypothesis to measure significant effect of Flow on Perceived Usefulness to use and Behavioral Intention to use in CCLM environment.

H6: Flow will have a positive effect on Perceived Usefulness to use of CCLM.
H7: Flow will have a positive effect on Behavioral Intention to use of CCLM.

**Perceived Ease of Use, Perceived Usefulness, and Behavioral Intention**

TAM, a model which modified TRA (Theory of Reasoned Action), clarifies relations between many different variables which affect technology use behavior of people who accept technology (Ajzen, 1991; Davis, 1989).

According to Davis (1989), Perceived Usefulness and Perceived Ease of Use perceived by a user have an effect on a user's interest in and attitude toward technological products. A user's attitude toward technological products is regarded as a factor which influences Technology Use Intention in actual use environment. Similarly, Technology Use Intention has an effect on actual behavior, and Perceived Ease of Use has a direct effect on Perceived Behavior. Thus, this study set Perceived Usefulness, Perceived Ease of Use and Behavioral Intention as variances.

The following H8, H9, H10, and H11 construct a hypothesis set to measure significance of variables based on TAM.

H8: Perceived Ease of Use will positively influence Flow of CCLM.
H9: Perceived Ease of Use will positively influence Perceived Usefulness of CCLM.
H10: Perceived Ease of Use will positively influence Behavioral Intention to use of CCLM.
H11: Perceived Usefulness will positively influence Behavioral Intention to use of CCLM.

Figure 1 is a model designed based on H1-H11 Hypotheses of this study. TAM original showed that Perceived Technological Usefulness and Perceived Ease of Use perceived by a user have an effect on Attitude toward technological products and behavioral intention (Davis, 1989).
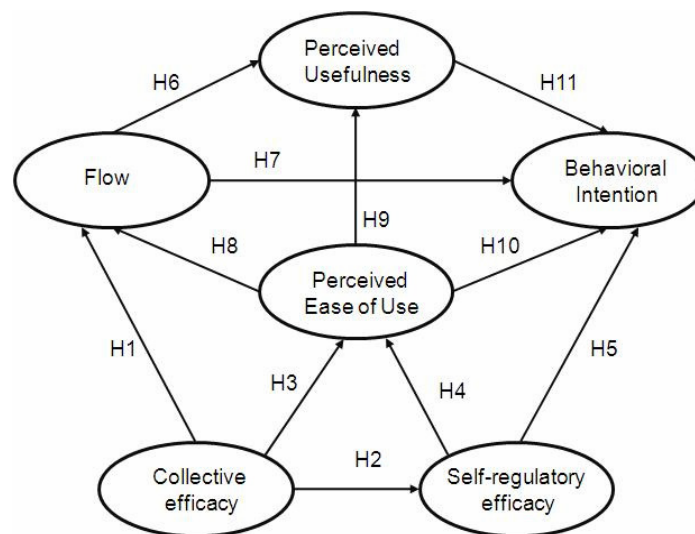


*Figure 1.* Research model and hypothesis

A user's attitude toward Technology is included in the model as a factor which influences Technology Use Intention in actual use environment. However, as previous studies showed that CCLM is generally related to Intrinsic motivation framework relevant to psychological elements of a learner as opposed to Technology Acceptance Model, collective efficacy, self-regulatory efficacy and flow variables were added to the model given that these variables are regarded as crucial in collaborative learning environment.

## Methodology

### Treatment

This study conducted an experiment with 106 students, who participated in a course at Chungang University, Korea, by applying web based CCLM. The experiment was conducted during 2 semesters in 2009 and 2010.

Web based CCLM for this study was designed using web café provided by a portal site in accordance with characteristics of the course. Especially, this model was designed on the basis of learning model suggested by Johnson & Johnson (1994) and Hayes (1996). "positive interdependency", "self-efficacy and collective efficacy", "web based interaction", "interpersonal relations and small group cooperative skills", etc. are main constructs of the framework.

As the number of students participating in the course was limited, it was difficult to secure sufficient sample group (population) for Structural Equation Modeling experiment, but students were divided into 6 groups (A group consists of 6 students.) according to their age, major discipline, gender, etc. in a way similar to Jigsaw model and performed learning tasks. Among 106 students, 4 students, who were not included in 17 groups, were respectively scattered and placed into 4 groups through interview and by considering computer application ability and major discipline of each group (Cohen, 1994).

In accordance with respective learning schedule, each group performed learning 9 times for 2 hours a week. Learning place and platform did not consider wire or wireless. After 2 weeks of learning, each group submitted products (writings) relevant to topics completed through collective composition, and each team performed discussion learning based on those products by accessing CCLM during the next week. Each team submitted final products (writings or compositions) through up-loading.

With regard to evaluation method, this study laid stress on completeness of writings on a certain topic, but also made much of collective efficacy ability using properties of web 2.0 interface technology including internet comments, argumentative correction activity, collective efficacy intelligence based conflict mediation and communication skills, etc. This study used digital archives as source of references. With regard to learning evaluation standards, this study assessed submitted writings or final products based on the degree of completeness and normative evaluation method recommended by the ministry of Education of Korea with "Internalization", "Socialization (sincerity in group)", "Externalization", "Combination', etc. set as main standards.

### Participants

Table 1 indicates the profile of the students who participated in the experiment. Among the students taking the course, 106 students participated in the experiment; the number of female students is 49 (46.2%), and the number of male students is 57 (57%). With regard to the age, 13 students are 19 years old (12.3%); 34 students are 20 years old 2 (32.1%); 42 students are 21 years old (39.6%); 12 students are 22 years old (12.3%); and 4 students are 25 years old (3.8%). Unlike other countries, there are relatively more college students 25 years old or so since most male students return to the university after two years of military service.

With regard to academic level of the students, 22 are freshman (1) (20.8%); 32 are sophomore (2) (30.2%); 36 are junior (3) (34.0%); and 16 are senior (4) (15.1%). With regard to major discipline, 41 students major in literature & humanity (38.7%); 35 students major in social science (33.0%); and 30 students major in science & engineering (28.3%). With regard to Experience in using web-based learning system, 89 students said Yes (84%); and 17 students said No (16.0). These results indicate that most courses at University in Korea make active use of computer regardless of major disciplines. With regard to a question about "Did you experience composition (writing) model using web-based learning system (or CCM)?", only 12 students (11.3%) said "Yes"; and 94 students (88.7%) said "No", which indicates that most students have not experienced web based CCLM model.

Table.1 Profile of the respondents

| | Gender | | Age | | Academic level | | Major | |
|---|---|---|---|---|---|---|---|---|
| Female | 49 (46.2%) | 19 | 13 (12.3%) | 1 | 22 (20.8 %) | Literature & humanity | 41 (38.7%) |
| Male | 57 (57%) | 20 | 34 (32.1%) | 2 | 32 (30.2 %) | Social science | 35 (33.0%) |
| Total | 106 (100.0 %) | 21 | 42 (39.6%) | 3 | 36 (34.0% ) | Science & engineering | 30 (28.3%) |
| | | 22 | 12 (12.3%) | 4 | 16 (15.1%) | | |
| | | 25 | 4 (3.8%) | | | | |
| Using web-based learning | | Yes | 89 (84%) | | | | |
| | | No | 17 (16.0%) | | | | |
| Learning system currently using | | Yes | 12 (11.3%) | | | | |
| | | No | 94 (88.7%) | | | | |

**Measure**

Measurement of variables in Table 2 is based on previous studies. All the questionnaire items used 7 point Likert-type scale where (1) = strongly disagree, (7) = strongly agree. Collective Efficacy to use was measured on a scale recommended by Bandura (1997, 2000); Wang and Lin (2007). Besides, Self- regulatory efficacy to use was measured on a scale recommended by Bandura (1997, 2000); Chohen Lent et al.(2006); Dembo (2000); Lee and Lee (2008); Printrich and Schunk (2002); Schunk (1990, 2001); Wang and Wu (2008). Flow to use was measured on a scale recommended by Agarwal and Karahanna (2000); Csikszentmihaly (1980); Huang, (2003).

The TAM constructs of Perceived Usefulness construct and Perceived Ease of Use were adapted from Ajzen, (1991), Davis (1989) and Yi and Davis (2007). The instrument consisted of items for the usefulness construct and five items for the ease of use construct. Behavioral intention items were measured on a scale recommended by Agarwal and Karahana (2000); Davis (1980).

Concretely, Collective efficacy items were constructs including "Find ways to bridge individual differences between team members", "Find ways to capitalize on the strengths of each member", "Adapt to changes in group learning task or goals","Assist members who are having difficulty with certain tasks", and "Communicate well with one another despite differences in cultural background"; and these 5 constructs were applied to the model.

Self- regulatory efficacy items were constructs including "I can judge what contents I have learned in class time, and what I do not know", "I know whether it is an effective method to

study", and " I can finish an assignment given within a fixed time". Flow items were" constructs including "have perceived enjoyment using", "have perceived curiosity", and "Using CCLM would be concentration".

The Perceived Usefulness items were 3 constructs including "CCLM would improve my learning performance in this course, "CCLM would Increase my learning productivity in this course, and "CCLM would enhance my learning effectiveness in this course".

The Ease of Use items were constructs including "CCLM would be find easy to use in this course", "CCLM would be clear and understandable in this course", "CCLM would be find flexible to interaction in this course", and "CCLM would be fine it easy to use". Behavioral Intention items were constructs including "CCLM is a good idea," and "Using CCLM is a wise idea". Table 2 lists the measurement of variables.

Table.2 Measurement of variables

| Construct & Variable | Item | Source |
|---|---|---|
| Collective efficacy (CE) | | Bandura, 1986, 1997, 2000; |
| CE1 | Find ways bridge individual differences (e.g., in age, major, or personality) between team members | Chen, et al, 2001; Earley,1993; Gibson et al., 2000; Lent et al., |
| CE2 | Find way to capitalize on the strengths of each member | 2006;Johnson & Johnson, 1992; Wang & Lin, 2007. |
| CE3 | Adapt to changes in group learning task or goals | |
| CE4 | Assist members who are having difficulty with certain tasks | |
| CE5 | Communicate well with one another despite differences in cultural background | |
| | | |
| Self- regulatory efficacy (SRE) | | Bandura, 1986, 1997, 2000; |
| SRE1 | I can judge what contents I have learned in class time, and what I do not know | Lent et al., 2006; Dembo,2000; Lee & Lee, |
| SRE2 | I know whether it is an effective method to study | 2008; Printrich & Schunk, 2002; Seo & Liies, 2009; |
| SRE3 | I can finish an assignment given within a fixed time | Wang & Lin,2007; Zimmerman. 1990. |
| | | |
| Flow | | Wang & Lin, 2007; Manuel |
| Flow1 | have perceived enjoyment using | j. Sanchez-Franco, 2009; |
| Flow2 | have perceived curiosity | Hwang, 2003; Li & Brown, |
| Flow3 | is concentration | 2006. |
| | | |
| Perceived Usefulness (PU) | | Ajzen, 1991; Davis,1989; |
| PU1 | Improve my learning performance | Wang & Lin, |
| PU2 | Increase my learning productivity | 2007.Wang,2008. |
| PU3 | Enhance my learning effectiveness | |
| | | |
| Perceived Ease of Use (PEOU) | | Ajzen, 1991; Davis,1989; |
| PEOU1 | is easy to use | Wang & Lin, 2007. |
| PEOU2 | find easy to get | |
| PEOU3 | find flexible to interaction | |
| | | |
| Behavioral Intention (BI) | | Ajzen, 1991; Davis, 1989; |
| BI1 | Using CCLM is a good idea | Agawal and Karahanna, |
| BI2 | Using CCLM is a wise idea | 2000. |

**Data Analysis**

**Measurement model**

The confirmatory fact analysis in AMOS$^{TM}$ was used to analyses construct validities. Following the two-step approached of structural equation modeling (SEM) analysis (Fornell & Larcker, 1981). The model included 19 items describing six latent construct. The measurement model was first evaluated in terms of reliability, convergent validity, and discriminate validity (Barclary et al., 1995).

Reliability was evaluated using Cronbach's alpha values. The resulting scores reflect the underlying dimensions more accurately than any of the individual items by accounting for the unique factors and error measurements that may also affect each item (Chin & Copal, 1995). The composite reliabilities and the average variance extracted (AVE) for the dimensions are over the recommended acceptable 0.70 level and 0.50 respectively. Relation on the other words, convergent and discriminate validities are assessed by applying the fact that the square root of the average variance extracted (AVE) by a construct from its indicators (a) should be at least 0.7 (i.e., AVE > 0.5); and (b) should be greater than that construct's correlation with other constructs, respectively (Barclay et al., 1995; Fornell & Larcker, 1981; Sanchez-Franco et al., 2009). The following step is testing the psychometric properties of the measurement model (see Table 3 and Table 4).

As shown in Table 3, all of the composite reliabilities (CRs) and Cronbach's alphas were over 0.70, indicating the scales had good reliabilities (Nunally, 1978). The standard loadings exhibited loading higher 0.70 on respective constructs, providing evidence of acceptable item convergence on intended constructs and significant at the 0.001. Furthermore, the average variance extracted (AVE) for each construct was over 0.50. The scales had good convergent validities (Fornell & Larcker, 1981).

| Scale Item | Loading | Cronbach's α | Measurement Error | Composite Reliability | AVE |
|---|---|---|---|---|---|
| CE3 | 0.793 | | | | |
| CE4 | 0.834 | | | | |
| CE5 | 0.833 | | | | |
| Self-regulatory efficacy (SRE) | | 0.786 | 0.207 | 0.881 | 0.712 |
| SRE1 | 0.786 | | | | |
| SRE2 | 0.726 | | | | |
| Collective efficacy (CE) | | 0.734 | 0.137 | 0.962 | 0.836 |
| SRE3 | 0.851 | | | | |
| CE1 | 0.818 | | | | |
| Flow | | 0.734 | 0.123 | 0.939 | 0.838 |
| CE2 | 0.850 | | | | |
| FLow1 | 0.859 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Flow2 | 0.819 | | | | |
| Flow3 | 0.763 | | | | |
| Perceived Usefulness (PU) | | 0.717 | 0.123 | 0.944 | 0.849 |
| PU1 | 0.789 | | | | |
| PU2 | 0.834 | | | | |
| PU3 | 0.766 | | | | |
| Perceived Ease of Use (PEOU) | | 0.706 | 0.119 | 0.942 | 0.846 |
| PEOU1 | 0.815 | | | | |
| PEOU2 | 0.784 | | | | |
| PEOU3 | 0.763 | | | | |
| Behavioral Intention (BI) | | 0.748 | 0.287 | 0.770 | 0.673 |
| BI1 | 0.824 | | | | |
| BI2 | 0.728 | | | | |

Table.3 Measurement model

Table 4 presents the correlations among constructs, with the square root of the AVE on the diagonal. In the testing results, the diagonal values exceed the inter-construct correlations. For satisfactory discriminate validity, the square root of AVE from the construct should be greater than the correlation shared between the construct and other constructs in the model (Fornell & Larcker, 1981). These results show that all square roots of the AVEs were larger than correlation coefficients of the factors (0.820-0.921), which verifies that the items measured exhibit sufficient validity (Nunally,1978). Accordingly, the test of discriminant validity was acceptable and the measurement for each construct satisfies construct validity.

| Discriminate Validity Coefficients | Components | | | | | |
|---|---|---|---|---|---|---|
| | CE | SRE | Flow | PU | PEOU | BI |
| Collective efficacy(CE) | **0.914** | | | | | |
| Self-regulatory efficacy(SRE) | 0.426 | **0.844** | | | | |
| Flow | 0.291 | 0.232 | **0.915** | | | |
| Perceived Usefulness (PU) | 0.496 | 0.405 | 0.585 | **0.921** | | |
| Perceived Ease of Use (PEOU) | 0.610 | 0.265 | 0.504 | 0.590 | **0.920** | |
| Behavioral Intention (BI) | 0.356 | 0.193 | 0.702 | 0.560 | 0.482 | **0.820** |

Table .4 Discriminant validity coefficients
Note: Diagonal elements (bold) are the square root of average variance extracted (AVE) between the constructs and their measurement. Off-diagonal elements are correlations between constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

**Structural model testing results**

Fig. 2 shows the standardized path coefficients for the model and their significance. The followings are the overall model fit and of each research hypotheses. The structural model and hypnosis are assessed by examine the significance of the path coefficients and the variance accounted for by the antecedent constructs.

As shown, the results of the full model. SEM results depicted in Fig.2 are $\chi^2=175.1$ ($p =0.001$), df=141, $\chi^2/df=1.24$, RMSEA (0.04), IFI (0.97), CFI (0.97), GFI (0.858), AGFI (0.808). Many studies using SEM accept Chi-square/ degree of freedom ($\chi^2/df$) should be less than 3, RMSEA (root mean square error of approximation) should be less than 0.05, GFI (goodness-of-fit index), adjusted GFI, IFI (incremental fit index), and CFI (comparative- fit index) in 0.8-0.9 confidence level (Lee et al., 2007). Accordingly, we could accept the results shown in Fig.2.
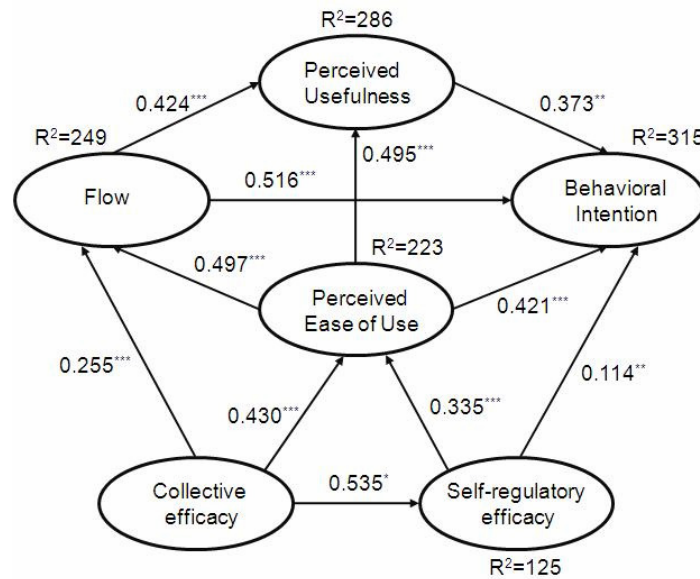


*Figure 2.* Hypothesis testing results for the pooled data (N=106; **p<0.01; ***p<0.001)

Fig. 2 provides the result of hypothesis testing. Supporting H1, Collective efficacy will have a positive effect on Flow to use CCLM ($\beta= 0.255$, $p < 0.001$). Supporting H2, Collective efficacy will have a positive effect on Self-regulatory efficacy of CCLM ($\beta= 0.535$, $p < 0.001$). Supporting H3, Collective efficacy will have a positive effect on Perceived Ease of Use of CCLM ($\beta= 0.430$, $p < 0.001$). Supporting H4, Self-regulatory efficacy will have a positive effect on Perceived Ease of Use of CCLM ($\beta= 0.335$, $p < 0.001$). Supporting H5, Self-regulatory efficacy will have a positive effect on Behavioral Intention to use the CCM ($\beta= 0.114$, $p < 0.01$). Supporting H6, Flow will have a positive effect on Perceived Usefulness to use of CCLM ($\beta= 0.424$, $p < 0.001$). Supporting H7, Flow will have a positive effect on Behavioral Intention to use of CCLM ($\beta= 0.516$, $p < 0.001$). Supporting H8, Perceived Ease of Use will

positively influence Flow of CCLM ($\beta$= 0.497, $p$ < 0.001). Supporting H9, Perceived Ease of Use will positively influence Perceived Usefulness of CCLM ($\beta$= 0.495, $p$ < 0.001). Supporting H10, Perceived Ease of Use will positively influence Behavioral Intention to use of CCLM ($\beta$= 0.421, $p$ < 0.001). Supporting H11, Perceived Usefulness will positively influence Behavioral Intention to use of CCLM ($\beta$= 0.373, $p$ < 0.001). As a result, all of the hypotheses were strongly supported at 0.01 level for the standardized path coefficients.

The model explained substantial variance in Perceived Usefulness to use of CCLM ($R^2$ =0.286), Perceived Ease of Use ($R^2$ =0.223), Flow ($R^2$ =0.249), Self-regulatory efficacy ($R^2$ =0.125), and Behavioral Intention to use of CCLM ($R^2$ =0.315). These results indicate that dependent variables in the model have more explanatory power than independent variables.


**Discussion and Conclusions**


Collaboration is a crucial condition to man as social animal in everyday life as well as learning. Comparing collaboration to air for socializing man, Johnson & Johnson (1989) stated that we overlook the importance of cooperative learning just as we fail to realize the importance of air even while we are breathing.

This study is a case study which applied collective composition learning model to improve heterogeneous group learning in a university convergence studies course. Recently, many scholars suggested varied research models relevant to collective composition on computer assisted collaborative learning with digital paradigm including collective composition model based on digital games.

Most CCLM is divided into 'academic writing', 'critical thinking and discussion', and 'expression of creative thinking'. 'Academic writing', involving attempting logical and critical writing aims at helping students develop ability to write thesis and research paper ultimately.

Generally, 'CCLM based critical thinking and discussion' course aims at helping students develop ability to speak logically through critical thinking and ability to write logically by writing comments about discussion issues. Accordingly, what is important in CCLM courses is to help students develop ability to maintain logical consistency in writing through open correction or face-to-face correction based on individual guidance (Johnson & Johnson, 1989).

For this study, the researchers paid attention to Hayes (1996) which suggested problem solving model from a social perspective through writing. Hayes (1996) model considered the following as important: First, Hayes set two axes 'individual' and 'environment' and stressed the importance of interaction between an individual and social environment through writing. Second, Hayes further spotlighted social perspective of writing by subdividing task environment into social environment and physical elements. Third, Hayes subdivided operating elements taking place inside an individual. In other words, the model includes visual and spatial elements as well as linguistic representation, and considers motivation and emotional elements as important. These elements are similar to ideas of this study which applied collective composition learning model to improve heterogeneous group learning.

Recently, convergence studies curriculum, to which many universities in Korea give importance, is supposed to be a significant form of course in that it enables students to learn both correlated curriculum and relevant curriculum, but it is difficult to maximize learning effects since heterogeneous groups including engineering majors, liberal arts majors, etc. participate in the course. To solve this problem, the researchers produced and applied CCLM based on web to actual classes. This study applied Jigsaw  model based learning model to

heterogeneous learning groups participating in the course, and gave difficulty level, learning subject or theme related to curriculum to each group. After 16 weeks or a semester, this study measured the results through a structural equation modeling (SEM) based on an extended TAM. Based on previous studies, this study set 6 measurement variables including Collective efficacy, Flow, perceived usefulness, perceived ease of use, behavioral intention, etc. (19 items), and conducted an experiment based on structural equation model. According to the results, web-based CCLM has a positive effect on collective efficacy, self-regulation, and Flow. Accordingly, all of these were accepted since path model also had signification. The results explain that research model has signification for learning performance of heterogeneous group.

The analysis results of $R^2$ values indicating explanatory power level of research model were as follows: Self-regulatory efficacy 24.9%, Flow 24.9%, Perceived Usefulness 28.6%, Perceived Ease of Use 22.3%, and Behavioral Intention 31.5%. Overall, the results suggest that the research model provided good explanatory power of learner's behavioral intention. Generally, research on ICT based on TAM always considers explanatory power of Behavioral Intention variance as well as computer self-efficacy (Eccles et al., 1983; Oliver, 1993).

Especially, this study conducted analysis of covariance structures to investigate causal relations between endogenous, and exogenous latent variables including Collective efficacy, Self-regulatory efficacy, Flow, Perceived Usefulness, Perceived Ease of Use, and Behavioral Intention variances based on research model. The results are as follows:

First, analysis results of direct effect of CCLM, Collective efficacy variance and Self-regulatory efficacy was 0.425, Perceived Ease of Use was 0.442, Self-regulatory efficacy variance and Perceived Ease of Use was 0.218; Perceived Ease of Use variance and Flow was 0.586, Perceived Usefulness was 0.499, Behavioral intention was 0.207, Flow variance and Perceived Usefulness was 0.212, Behavioral Intention was 0.541, and Perceived Usefulness variance and Behavioral Intention was 0.089.

Second, analysis results of indirect effect of CCLM, Collective efficacy variance and Perceived Ease of Use was 0.256, Flow was 0.378, Perceived Usefulness was 0.280, Self-regulatory efficacy variance and Flow was 0.107, Behavioral Intention was 0.128, Perceived Ease of Use variance and Perceived Usefulness was 0.17, Behavioral Intention was 0.428, and Flow variance and Behavioral Intention was 0.22.

Third, analysis results of total effect of CCLM, Collective efficacy variance and Flow was 0.313, Self-regulatory efficacy was 0.425, Perceived Ease of Use was 0.534, Perceived Usefulness was 0.333, and Behavioral intention was 0.294. Self-regulatory efficacy variance and Perceived Ease of Use was 0.218, Flow was 0.128, Perceived Usefulness was 0.136, and Behavioral Intention was 0.96. Perceived Ease of Use variance and Flow was 0.586, Perceived Usefulness was 0.623, and Behavioral Intention was 0.586. Flow variance and Perceived Usefulness was 0.212, Behavioral Intention was 0.56. Perceived Usefulness variance, Behavioral Intention variance and Perceived Usefulness variance was 0.089.

In summary, with regard to CCLM applied to this study, Collective efficacy in heterogeneous group learning environment has an effect on Self-regulatory efficacy, Flow, Perceived Ease of Use, Perceived Usefulness, and Behavioral Intention; and Collective efficacy, Flow, and Perceived Ease of Use variance have the greatest effect on heterogeneous learning group's Behavioral Intention. It was also found that CCLM model has an effect on Collective efficacy and Flow, Self-regulatory efficacy. These results of experiment explain that CCLM Model suggested by this study is a significant model for heterogeneous group learning. In other words, CCLM can play a significant role in providing goals, individual accountability and equal opportunity to heterogeneous group with different propensities. Thus, CCLM suggests the

possibility that it can be used as a significant model which contributes to improving or developing future oriented attitude, cognitive strategy, critical thinking, socialization and learning attitude of learners.

While variables verified by this study have effectiveness, it is difficult to say that CCLM is a model suited for all social heterogeneous groups. However, CCLM is widely being used in various areas like social psychological therapy including art therapy, narrative therapy, cinema therapy, etc. as well as education in Korea. Based on this study, we will attempt to extend research into therapy area associated with digital addiction, which has become a social issue in Korea.

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