An Examination of the Causal Model for the Relationships among Self-Efficacy, Anxiety, Self-Regulated Learning Strategies, and Persistence in Learning
Focused on Cognitive and Motivational Aspects of Self-Regulated Learning Strategies*

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Received for publication, July 10, 2004

The present study tests a causal model for the relationships among self-efficacy, anxiety, self-regulated learning strategies, and persistence in learning. The following instruments were used: self-efficacy scale; scale of feelings of anxiety while studying; cognitive self-regulated learning strategies scale; self-motivational strategies scale; and the subscale of the Gakugeidai Academic Motivation Inventory measuring a lack of persistence in learning. These scales were administered to 449 junior high school students twice, 1 month before and 1 week before examination. The results, analyzed using structural equation modeling, were as follows: (1) self-efficacy predicted cognitive self-regulated learning strategies and intrinsic regulation strategy positively, whereas self-efficacy predicted extrinsic regulation strategy negatively; (2) feelings of anxiety influenced all three self-regulated learning strategies positively; (3) intrinsic regulation strategy was related negatively to a lack of persistence, but extrinsic regulation strategy was related positively to a lack of persistence.

Key words: self-efficacy, anxiety, self-regulated learning strategies, persistence in learning, causal model, junior high school students

1. INTRODUCTION

The national curriculums in Japan have emphasized the necessity to cultivate the "faculty of self-learning" and the "faculty of self-education" since the 1980s, and more recently the importance of developing in students the "capabilities to learn and think on their own", namely, "ikiru chikara" (capacity to live) as an educational goal (the Ministry of Education, Science and Culture of Japan, 1996).

International educational research has increasingly been using the concept of "self-regulated learning" (Zimmerman and Schunk, 2001). Zimmerman (1986, 1989) stated, "in general, students can be described as self-regulated to the degree that they are metacognitively, motivationally, and behaviorally active participants in their own learning process". Metacognitively, self-regulated learners are persons who plan, self-monitor, and self-evaluate at various stages during the learning process. Motivationally, self-regulated learners perceive themselves as competent, self-efficacious, and autonomous. Behaviorally, self-regulated learners select, structure, and create social and physical environments that optimize learning.

Zimmerman (1989) stressed the importance of three elements in self-regulated learning: self-regulated learning strategies; self-efficacy; and commitment to academic goals. Self-regulated learners use self-regulated learning strategies for reaching academic goals. As a result, if they perform better, they display higher self-efficacy. Self-efficacy increases their motivation for learning, and learners continue using self-regulated learning strategies for acquiring more knowledge and skills.

Self-regulated learning strategies are defined as "the volitional regulations to process information more effectively by a learner during the learning process" (Hayamizu, 1998). Earlier research

focused on cognitive self-regulated learning strategies, such as cognitive strategies and metacognitive strategies. Cognitive strategies refer to strategies to promote effective learning by regulating the cognitive processes of thinking and memory, for example, by organizing and transforming information for better understanding, and using rehearsal for memorizing. Metacognitive strategies are strategies to regulate the learning process effectively through metacognitive functions: planning, self-monitoring; and self-evaluation.

Research has shown that self-regulated learning strategies determine academic achievement directly, and self-efficacy promotes the use of self-regulated learning strategies. For example, Zimmerman and Martinez-Pons (1990) found that self-efficacy increased with higher grades, and gifted students displayed higher self-efficacy and use of strategies than regular students. In addition, students’ perception of efficacy was related to their use of self-regulated learning strategies. Pintrich and DeGroot (1990) showed that self-efficacy was associated with use of self-regulated learning strategies (metacognitive and effort management strategies, and cognitive strategies) and learning strategies had a direct influence on academic performance. Pokay and Blumenfeld (1990) found using path analyses that the perceived value of the subject matter and expectations of succeeding (i.e., self-efficacy) predicted use of strategies (metacognitive, general cognitive, subject-matter specific, and effort management), and the use of subject-matter specific and effort strategies influenced grades early in the semester. Metacognitive strategy use predicted grades late in the semester.

The empirical studies showed that self-efficacy predicts the use of self-regulated learning strategies and strategy use influences academic performance. Most studies constructed scales and analyzed causal relationships focusing on the regulation of cognitive process in learning, such as cognitive and metacognitive strategies involving thinking and memory. However, self-regulated learning strategies involve not only cognitive aspects but also motivational aspects of regulation, promoting and maintaining the motivation to learn effectively (Corno 1994, Boekaerts 1995). Past research focusing on motivational aspects did not categorized the content of scale items, which often were too superficial and abstract to use for supporting students’ learning. Ito and Shinto (2003) administered a survey to junior high school students and collected more concrete and detailed items assessing a wide range of content to construct a self-motivational strategies scale consisting of eight subscales. These subscales could be divided into “intrinsic regulation strategies” and “extrinsic regulation strategies”. Intrinsic regulation strategies regulate the task of studying and learning to create, maintain, and promote personal motivation, such as increasing the enjoyment of and interest in learning itself and valuing study. Extrinsic regulation strategies regulate motivation by external aids: attaining praise, evaluation, and rewards from others, or reducing the burden of tasks and homework.

The present research examines how motivational aspects of self-regulated learning strategies influence academic achievement, focusing on self-motivational strategies. Previous research frequently has used grades as an index of academic achievement. Cognitive self-regulated learning strategies make learning more efficient and therefore predict grades directly. However motivational self-regulated learning strategies regulate motivation for learning and therefore promote persistence in learning. The persistence would then eventually produce better grades.

In this paper, we examine the functioning of self-motivational strategies, and differences in predictions between cognitive and motivational strategies. Motivational strategies are predicted to influence persistence in learning more than cognitive strategies. Research has shown that among self-motivational strategies, intrinsic regulation strategies are related to intrinsic motivation and extrinsic regulation strategies are related to extrinsic motivation (Wolters, 1998; Ito and Shinto, 2003). Intrinsic regulation strategies combined with intrinsic motivation are predicted produce persistence in learning because intrinsic motivation provides strong persistence, deep cognitive processing and high achievement. But extrinsic regulation strategies depending on external aids are not predicted to be related to persistence. In the present research, these predicted relationships are analyzed using covariance structure analysis.

Moreover, we use anxiety and self-efficacy as additional variables in investigating the difference in functioning between cognitive and motivational aspects of self-regulated learning strategies. Study on anxiety in academic situations originated with the research of Sarason and Mandler (Sarason and Mandler, 1952; Mandler and Sarason, 1952). Recently several researchers have examined anxiety focused on specific subjects such as
mathematics and science. Some studies on test anxiety reported that highly anxious students had some problems with study habits and did not use effective learning methods (Culler and Holahan, 1980; Benjamin et al., 1981). However, other research suggested that test anxiety was not related to the use of self-regulated learning strategies (Pintrich and De Groot, 1990; Shiomi and Komai, 1995; Shiomi et al., 1997). A study of mathematics anxiety (Meece et al., 1990) showed that math anxiety was negatively related to self-efficacy, and math anxiety did not determine grades directly but self-efficacy did. In this study self-regulated learning strategies were not investigated. Shiomi and Komai (1995) showed that science anxiety was negatively related to self-efficacy, and there was negative relation between science anxiety and self-regulated learning strategies. Bandura (1997) reviewed the research on self-efficacy and suggested that there was negative relation between self-efficacy and anxiety, and that self-efficacy was a strong predictor of achievement behavior. But in general the results from studies examining the relation between anxiety and cognitive learning strategies have been inconsistent. Many researchers suggested that anxiety either had no influence or a negative influence on academic achievement.

On the other hand, there are researchers who explore the processes of test anxiety from the viewpoint of psychological stress theory. Research on stress has found that high test anxiety is linked to use of specific stress-related coping strategies. For example, emotion-focused coping strategies such as avoidant and confrontive coping promoted test anxiety in university students (Blankstein et al., 1992). Test anxiety was related to avoidant coping strategies in high school students (Zeidner, 1996). On the other hand, Miura et al. (1997) found that highly test-anxious students used more positive coping strategies: "study harder" and "divert themselves." They investigated the successive changes in test anxiety from two weeks before to one week after a mid-term examination and found that highly test-anxious students appraised tests as more threatening as well as more important, and tended to have positive thinking. In other words, they attempted to think "try their best" and attached more importance to learning. Thus, high test-anxious students seem inclined to utilize more avoidant as well as positive coping strategies than low test-anxious students. Consequently, highly anxious students use both intrinsic regulation strategies related to positive coping and extrinsic regulation strategies related to avoidant coping (Ito and Shinto, 2003).

The present research assumes that by measuring feelings of anxiety while studying during the weeks to prepare for an examination, instead of measuring test anxiety, we will be able to test the following prediction: feeling of anxiety → use of self-regulated learning strategies → persistence in learning. Although test anxiety in test situations generally impedes achievement, it is possible that feelings of anxiety during the preparatory periods before an examination promote the use of cognitive and motivational aspects of self-regulated learning strategies, and then these strategies produce persistence in learning. This possibility is suggested by the research of Miura et al. (1997) on the successive changes of test anxiety that found highly test-anxious students also tended to have a positive thinking.

The present research was designed to investigate students' feelings of learning-related anxiety and self-efficacy at one month before an examination, and the use of cognitive and motivational self-regulated learning strategies from three weeks to one week before the examination, and persistence in learning one week before examination. We attempt to clarify the differences between cognitive and motivational strategies by testing a hypothetical causal model (self-efficacy and anxiety → use of self-regulated learning strategies → persistence in learning) using covariance structure analysis.

2. METHOD

2.1. Sample and Procedure

Questionnaires were administered to 449 junior high school students in a public school in Kobe city, Japan. The students were in the first to third grades (72 boys and 86 girls in the first grade, 72 boys and 82 girls in the second grade, 74 boys and 63 girls in the third grade). The data from 349 students (53 boys and 67 girls in the first grade, 55 boys and 67 girls in the second grade, 54 boys and 53 girls in the third grade) was analyzed. Students were also surveyed at two times. The first survey was between January 27 and February 1 in 1999 and the second was between February 17 and February 22 in 1999.

The homeroom teachers administered the questionnaires to their classes. As described below, the first questionnaire was administered
one month before the students’ examinations, and the second questionnaire was administered one week before the examinations. Students were told that their responses on the questionnaires would not influence their grades.

2.2. Measures  
The first questionnaire, administered one month before examinations, assessed self-efficacy and anxiety. It consisted of 10 items as described below. See the Appendix for the actual items used. Students were instructed to respond to the items on a 5-point Likert scale (1 = “not at all true of me” to 5 = “very true of me”).

Self-efficacy. The wording the four items on the self-efficacy scale of Ito (1996) was changed slightly in order to apply to the junior high school students’ academic situation.

Feeling of anxiety while learning. The six items that showed the highest item-remainder correlation on the state anxiety scale in the Japanese version of the STAIC (Soga, 1983) were used. The wording was changed slightly to apply to learning in the students’ usual situation.

The second questionnaire was administered three weeks after the first, which was one week before the students’ examinations. The questionnaire consisted of 41 items making up the following three scales and subscales. See the Appendix for the actual items used.

Cognitive aspects of self-regulated learning strategies. Use of cognitive aspects of self-regulated learning strategies was measured by the 14 items from Ito (1996): “general cognitive strategies” (5 items), “reviewing and summarizing strategies” (5 items), “rehearsal strategies” (2 items) and “connecting strategies” (2 items). Students were instructed to respond to these items on a 6-point Likert scale (1 = “not at all true of me ” to 6 = “very true of me”) referring to their use of the strategy during the previous two weeks.

Motivational aspects of self-regulated learning strategies. Two subscales of motivational aspects, intrinsic and extrinsic regulation strategies, were measured by the self-motivational strategies scale (Ito and Shinto, 2003). This scale consists of 27 items, divided into the following subscales: “intrinsic regulation strategies” subscale consists of “foresight” (4 items), “time management” (3 items), “value of contents” (3 items), “organization” (5 items) and “social interaction” (3 items), and the “extrinsic regulation strategies” subscale consists of “reward” (4 items) and “captivating study material” (5 items). Students were instructed to respond to these items on a 5-point Likert scale (1 = “did not do at all” to 5 = “always did”) referring to their use of the strategy during the previous two weeks.

Persistence in learning. Persistence in learning was assessed by the 5-item subscale of the Gakugeidai Academic Motivation Inventory (GAMI) measuring a lack of persistence in learning. Students were instructed to respond to items on a 4-point Likert scale (1 = “not true of me” to 4 = “very true of me”).

3. RESULTS

3.1. Observed variables  
Based on the result of the factor analysis using the principal factor method with each of the scales of self-efficacy, feeling of anxiety while learning and a lack of persistence, it was confirmed that one-factor solutions were valid because first eigen value was sufficiently higher than the second and the subsequent eigen values. Each of the three items with the highest factor loading was adopted as the observed variables. Also, for each of the subscales of cognitive self-regulated learning strategies and motivational self-regulated strategies, it was confirmed that one-factor solutions were valid, based on the factor analysis by the principal factor method. The average scores of each subscale were used as observed variables.

3.2. Construction of model  
Based on the hypotheses, the model was designed to treat “self-efficacy”, “feeling of anxiety while learning”, “cognitive self-regulated learning strategies”, “intrinsic regulation strategies”, “extrinsic regulation strategies” and “persistence in learning” as six latent variables. We hypothesized the paths from “self-efficacy” and “feeling of anxiety while learning” to these three strategies, and moreover the paths from the same three strategies to “persistence in learning”. A correlation between self-efficacy and anxiety was assumed, based on the results of the previous research. Also, covariance between error variables of cognitive self-regulated learning strategies and intrinsic regulation strategies was estimated as a free parameter. This was based on the reason why
Self-Regulated Learning Strategies and Motivation

Fig. 1. The result of covariance structure analysis. Values indicate standardized solutions. Error terms and correlations are omitted. SE, A and LP are shown for each item.

it was able to assume some factors except self-efficacy and anxiety, for example, intrinsic motivation or valuing learning that influences both cognitive self-regulated learning strategies and intrinsic regulation strategies. The resulting hypothetical causal model is shown in Figure 1.

3.3. Testing the model

The standardized estimates obtained as the results of the covariance structure analysis are shown in Figure 1. Effective indicators of all observed variables shown are higher than .45 and are significant ($p < .01$). We conclude that each construct appropriately corresponds to each observed variable. In addition, the values of the goodness of fit indices were GFI=.91, AGFI=.88, CFI=.91 and RMSEA=.06, which indicates that the model fits the observed data well. Thus the hypothesized model explained the covariance matrix well.

Regarding path coefficients among the constructs, all paths from "self-efficacy" to "cognitive self-regulated strategies", "intrinsic regulation strategies" and "extrinsic regulation strategies" (.33, .28, .43 respectively) were significant ($p < .01$). Students with perceived higher self-efficacy used more cognitive self-regulated learning strategies and intrinsic regulation strategies, but fewer extrinsic regulation strategies. Also, all the path coefficients from "feeling of anxiety" to these three strategies (.31, .40, .22 respectively) were significant ($p < .01$). It was shown that more highly anxious students used all the self-regulation strategies.

Regarding influences on "a lack of persistence", the path coefficients from "intrinsic regulation strategies" (-.27) and "extrinsic regulation strategies" (.94) were significant ($p < .01$), but the path coefficient from "cognitive self-regulated learning strategies" (-.04) was not significant. Use of "intrinsic regulation strategies" was negatively related to "a lack of persistence", whereas use of "extrinsic regulation strategies" was positively related to "a lack of persistence". The influence of use of "cognitive self-regulated learning strategies" on "a lack of persistence" was not detected.
Also, the assumed correlation between self-efficacy and feeling of anxiety was $r = -0.10$. It was negative as previous research suggested, but it was unexpectedly low. This result is related to a suggestion from the research of Miura et al. (1997) that highly test-anxious students tended to have a positive thinking as well. The correlated errors of "cognitive self-regulated strategies" and "intrinsic regulation strategies" was $r = 0.68$.

4. DISCUSSION

This study assumed a causal model (self-efficacy and anxiety $\rightarrow$ use of self-regulated learning strategies $\rightarrow$ persistence in learning) and tested it using covariance structure analysis. The results showed that self-efficacy promoted the use of cognitive self-regulated learning strategies as well as intrinsic regulation strategies, but inhibited the use of extrinsic regulation strategies. In addition, intrinsic regulation strategies were positively related to persistence in learning, whereas extrinsic regulation strategies were negatively related to persistence in learning. Past studies have shown that students with high self-efficacy highly used cognitive self-regulated learning strategies. But this study found that high self-efficacious students used motivational self-regulated learning strategies as well, especially intrinsic regulation strategies that were adaptive and positive because they heightened enjoyment, interests, and values. Many previous researchers have suggested that self-efficacy influences persistence, and that highly self-efficacious students persevere and do not easily give up studying. But the results of the present study indicate that highly self-efficacious students maintain their persistence in learning by regulating themselves based on the use of self-motivational strategies like intrinsic regulation strategies.

We assume that feelings of anxiety influence the use of all self-regulated learning strategies. Generally it has been suggested that anxiety in test situations negatively influences academic achievement. But the present study shows that anxiety related to learning before an examination was positively related to use of cognitive self-regulated learning strategies and intrinsic regulation strategies as motivational self-regulated learning strategies. Intrinsic regulation strategies promoted persistence in learning. But anxiety also promoted extrinsic regulation strategies, and these strategies inhibited persistence, as was found in research on stress coping. Although anxiety influenced persistence negatively as a whole, at the same time, it was suggested that anxious students used motivational strategies like intrinsic regulation strategies to persevere in studying, as the report of Miura et al. (1997) indicated.

We assumed that extrinsic regulation strategies were negatively related to persistence in learning. Although extrinsic regulation strategies are supposed to promote and maintain motivation, it is difficult for those strategies to produce strong perseverance because they depend on external aids like praise, evaluation by other, and rewards etc. Extrinsic regulation strategies are related to emotion-centered coping (Ito and Shinto, 2003). There is a possibility that those strategies function as a buffer that promotes effective learning by debilitating the excessive burdens of studying and academic stress. Future research needs to examine these adaptive aspects of motivational strategies.

This study did not find that cognitive self-regulated learning strategies had an influence on persistence in learning. Based on previous research findings, cognitive self-regulated learning strategies may determine academic achievement directly as the result of cognitive activity because those strategies make cognitive activity itself more effective rather than regulating motivation. Since the present study primarily examined the relationship between cognitive strategies and persistence, including motivational strategies, therefore it was difficult to find the effects of cognitive self-regulated learning strategies.

Mainly previous interventional studies have promoted and supported learning by focusing only on cognitive self-regulated learning strategies. But according to the results of the present research study, it is necessary to promote motivational aspects of self-regulated learning strategies as well. This will heighten persistence in learning and the influences of self-efficacy should lead to positive academic achievement. Focusing on feelings of anxiety before an examination might help promote the use of adaptive self-regulated learning strategies and, as a result, lead students to become more effective learners.

5. CONCLUSIONS

We administered successive questionnaires to junior high school students one month and one week before an examination, and analyzed the responses with covariance structure analysis to
test a hypothetical causal model (self-efficacy and anxiety \rightarrow use of self-regulated learning strategies \rightarrow persistence in learning). We found the following results:
(1) Self-efficacy positively predicted the reported use of cognitive self-regulated learning strategies and intrinsic regulation strategy.
(2) Self-efficacy negatively predicted the use of extrinsic regulation strategy.
(3) Feelings of anxiety one month before an examination positively influenced students’ reported use of three self-regulated learning strategies.
(4) Intrinsic regulation strategy was related negatively to a lack of persistence.
(5) Extrinsic regulation strategy was related positively to a lack of persistence.
Cognitive self-regulated learning strategies did not have any influence on persistence in learning.

We would like to express our sincere gratitude to Professor Hirofumi Koishi of Kobe University and Professor Toshihiko Hayamizu of Nagoya University, and also the students and teachers who cooperated in this investigation.

NOTE

1) Considering the possibility for multi-collinearity, we divided the data at random and re-calculated and re-analyzed it after changing the observed variables to items with low factor loadings. The resulting analyses all confirmed the previous findings, with similar path coefficients and correlations. Goodness of fit indices showed GFI=.87-.91, AGFI=.83-.88, CFI=.86-.91, and RMSEA =.06-.08. Partly effective indicators of observed variables were lower scores (the lowest score was -.34) and the goodness of fit indices were a little lower because all the items from the “Feelings of anxiety while studying” scale among the changed items were the reverse-scored items.

REFERENCES

APPENDIX

The following scales and items were used in this study. Items marked (R) were reflected before scale construction.

Self-Efficacy (4 items)
I expect to do very well. (SE1)
I am confident to learn the material in this class. (SE2)
I think I will be good at studying. (SE3)
I think I will receive a good grade in this class. (SE4)

Feelings of Anxiety while Studying (6 items)
I feel anxious when I am studying. (A1)
I grow uneasy when I am studying. (A2)
My heart beat fast with anxiety while studying. (A3)
I can learn with a sense of relief. (R)
I am calm while studying. (R)
I can study with easy feeling. (R)

Cognitive Self-Regulated Learning Strategies (14 items)

General Cognitive Strategy (5 items)
When I study for a test, I try to put together the information from class and from the book.
When I do homework, I try to remember what the teacher said in class so I can answer the questions correctly.
When I study I put important ideas into my own words.
I always try to understand what the teacher is saying even if it doesn’t make sense.
When I study for a test I try to remember as many facts as I can.

Reviewing and Summarizing Strategy (5 items)
When studying, I copy my notes over to help me remember material.
I work on practice exercises and answer end of chapter questions even when I don’t have to.
Even when study materials are dull and uninteresting, I keep working until I finish.
When I study for a test I practice saying the important facts over and over to myself.
I arrange the points I learned for understanding well.

Rehearsal Strategy (2 items)
When I’m reading I stop once in a while and go over what I have read.
When I read material for this class, I say the words over and over to myself to help me remember.

Connecting Strategy (2 items)
I use what I have learned from old homework assignments and the textbook to do new assignments.
When reading I try to connect the things I am reading about with what I already know.

Intrinsic Regulation Strategies (18 items)

Foresight (4 items)
I think that if I try hard, I can enter the high school I want to go.
I think that studying will benefit me in the future.
I recall having succeeded in the previous tests.
I do not dwell on my own personal problems.

Time management (3 items)
I put in 100% when studying and I put in 100% when playing.
I try to study as much as possible in a short time.
I decide the amount and time to study by thinking, “I will do up to here”.

Value of contents (3 items)
I relate the materials of study with things that I know well and I am interested in.
I relate the materials of study with something familiar to me.
I memorize the materials of study by making up play on words or connecting them with a song.

Organization (5 items)
I mark main points in the textbook with my highlighter pen and take notes with pens of
varied color.
I make sure my notes are neat, tidy and legible.
I draw pictures to illustrate my notes.
I tidy my workspace before studying.
I adjust the lighting and room temperature to a comfortable setting.

Social interaction (3 items)
I exchange information with my circle of friends and we quiz each other.
I study with my friends.
I consult my peers about how to study effectively.

Extrinsic Regulation Strategies (9 items)
Reward (4 items)
When I finish studying and can do the problem, I eat a snack.
I eat and drink while studying.
While studying, I think, “I will play when I finish my study”.
When I do well in study and in tests, I get rewarded by my parents.

Captivating study material (5 items)
I study material that I have previous knowledge of and enjoy.
I start studying from a point that is not too difficult to help me achieve good grades.
I change the subject of my study when I can no longer concentrate on it.
I take short breaks during the course of my study.
I do not force myself to study, but do it when I have a desire to.

Lack of Persistence in Learning (5 items)
I start studying and I get weary in no time. (LP1)
When I wrestle some difficult task, I get tired soon and often stop doing. (LP2)
If there is something else interesting while studying, I give up my study. (LP3)
I think I am fickle.
When I watch my favorite TV program, I can’t set about my study on the scheduled time.