Verification of Mediated Effect of Athletic Ability Beliefs in the Relations between Learning Environments Perceived in the Physical Education (PE) Class and Task Persistence

Ki-Hyun Song¹ and Seung-Yong Kim²*

¹Department of Physical Education, Cheongju-si, Chungcheongbuk-do, 28173, Korea; vtr886@naver.com
²Han yang University, Division of Sports and Well-Being, Ansan-si, Gyeonggi-do15588, Korea; sykim@hanyang.ac.kr

Abstract

Objectives: The purpose of this study was to inquire into the mediated effect of athletic ability beliefs in the relations between the PE learning environments perceived in the PE class and task persistence. Methods/Statistical Analysis: To achieve such a research purpose, this study selected a total of 418 copies as final valid sample using convenience sampling of junior high school students at the five schools located in a metropolitan area. As for data processing, this study implemented hypothesis testing after confirming the goodness of fit test of the whole model using SPSS 18.0 and AMOS 18.0. Findings: First, effort and challenge perception in PE learning environment was confirmed to have a positive influence on increased beliefs while competence perception was found to have a negative influence on fixed beliefs and threat perception was found to have a positive influence on entity belief. Second, it was found that increased beliefs in athletic ability beliefs had a significant influence on task persistence positively while entity belief didn’t have a significant influence on task persistence. Third, it was found that effort, challenge perception, and competence perception of learning environment had a positive influence on task persistence. Lastly, it was confirmed that increased beliefs in the relations between effort, challenge perception and task persistence of learning environment play a mediating role. Improvements/Applications: This study confirmed that students’ aggressive class participation behavior calls for the learning environment, which is challenging, and makes it possible for students to put in a great deal of effort for their learning process, and a positive belief and volition that students themselves can do it in the results of this research.

Keywords: Athletic Ability Beliefs, Learning Environment, PE Class, Task Persistence, Tendency

1. Introduction

School physical education is an important place for learning to accelerate adolescents’ physical activity. Also, a motivation of the students participating in the PE class could have a positive influence not only on task performance but also on the physical activity level during their free time¹. Accordingly, it’s necessary to understand their learning environment above all in order to assist them in experiencing positive emotion.

If students should be satisfied with their learning experience, they will feel value while perceiving themselves as positive⁴. Accordingly, learning environment in school classes could be an important variable having a positive or negative influence on each student’s psychological, emotional trait, or cognitive learning result⁵. Also, a teacher is able to perform the most independent role in forming a student’s learning environment, and to create the learning environment of diverse moods together with
students. Through such learning environment, students get to be motivated to do learning or to receive a stimulus.

Naturally, a motive of a student is manifested from a variety of resources, but an internal motive is the level of an individual choice of the intention of participation because of the pleasure from activity itself rather than an individual purpose of obtaining a certain reward from outcomes; therefore, the internal motive is very important, especially in the PE class situation which requires aggressive physical activities. Hereupon put concern for the learning environment perceived by students as a factor that can enhance students’ internal motive according to the theoretical basis that students’ psychological state could change by virtue of learning environment; according to his research argued that the challenging, non-threatening learning environment is an important factor in forecasting students’ internal motive.

Afterward, in the studies reported by many researchers, the perceived learning environment has been known to have a great influence on students’ internal motive and physical activity level. Like this, learning environment in the PE class plays a very important role in students’ motive and behavior. Recently, there have been attempts to understand a motive in a learning situation from various theoretical perspectives, various motivation theories (ex: Achievement Goal theory, Self-Determination theory, Self-Efficiency theory, Expectancy-Value theory, and Self-Theory of Ability, etc.) have been reported as important preemptive variables having an influence on students’ behavior change, such as students’ task persistence & effort, etc. with the theories applied to the PE class.

Athletic ability beliefs out of them are based on self-theory of ability which is a part of the implicit theory proposed in an effort to explain conceptualization of diverse goals in school achievement area. According to a student’s beliefs in one’s ability are divided into the incremental belief which thinks that the ability improves by virtue of learning and effort, and entity belief which thinks that ability itself is in the blood and also stable, and thus it won’t change greatly in spite of learning and endeavors. In reported that there might be the individual difference, but it’s possible to possess both of the two sorts of beliefs, and a specific belief could be much stronger.

Recently, researchers have explained students’ motive by applying the implicit theory of ability to the PE class; for instance and reported that the mastery mood perceived in the PE class accelerates the belief in the increase of athletic ability through learning and effort while the performance mood accelerates the fixed belief that the athletic ability is one’s natural talent, and also won’t change easily. Such a result implies that the belief in students’ athletic ability can mediate the relations between learning environment perceived in the PE class and continuous behavior which are an active class attitude.

The researches, which have been performed in general learning and the PE class all this while, are showing the fact that the belief in an ability has an influence on students’ emotion, cognition and behavior. Particularly, the belief in one’s own ability at the scene of learning induces the student to aim at diverse goals, and the more a student has an increased belief, the more actively the student shows learning (task) objectives setting, positive emotion and effective problem-solving, etc., whereas a student having a fixed belief, is more likely to show a task-evasion behavior with performance (self) objectives setting, negative emotion, and maladjusted problem-solving strategies. The fact like this suggests that student beliefs in an ability in the PE class works as the valence which can elicit the change into a positive class attitude.

All this while, the researches performed at the scene of school PE show a PE teacher’s behavior and learning environment are the most important variables in determining students’ attitude towards physical education but nowhere is found the research on the mediated role of ability beliefs in the relations between learning environment and task persistence behavior, which is an aggressive participation behavior as yet. Accordingly, this study is intending to arrange an effective class strategy, and provide basic information to the related research by analyzing the structural relationship between a student-perceived learning environment, ability beliefs, and task persistence, and verifying the mediated effect of ability beliefs in the relations between learning environment and task persistence on the basis of the above empirical research results and theoretical grounds.

2. Research Method

2.1 Research Subjects

This study selected 500 students at the five junior high schools located in a metropolitan area using purposive sampling among the non-probability sampling and used the data from 418 students excluding 82 copies, which replied unfaithfully, as the final valid sample. As for the
surveyed preparation of a questionnaire, this study utilized the self-administration method; looking into the characteristic of the research subjects, the surveyed consisted of 203 male students (48.6%), and 215 female students (51.4%), and by school year, the surveyed consisted of 153 in the first grade (36.6%), 102 in the second grade (24.4%), and 163 in the third grade (39%).

2.2 Research Tools

2.2.1 Learning Environment
This study used Physical Education Learning Environment Scale, which was used by who verified validity targeting a junior high school student participating in domestic PE classes to look into the learning environment of the PE class perceived by students. This questionnaire is composed of a total of 11 question items covering 5 question items for effort/challenge perception environment, 3 question items for threat perception, and 3 question items for competence perception, and composed the questionnaire response pattern is composed of the 5-point Likert scale. Also, the reliability coefficient of each factor showed a stable numerical value with .953 in effort/challenge perception, .902 in competence perception, and .879 in threat perception.

2.2.2 Athletic Ability Beliefs
As for the questionnaire to look into students' ability beliefs, this study used the ability beliefs test, which was used to meet the PE class situation by at home by adopting Conceptions of the Nature of Athletic Ability Questionnaire Version 2; CNAAQ-2, developed by on the basis of the implicit theory through its application to PE and sports; this study used the ability beliefs test by modifying and complementing it in keeping with the research purpose. The questionnaire includes two factors-entity belief and increase belief as components, a total of 15 question items, and 5-point Likert scale. Also, the reliability coefficient of individual factors showed a stable numerical value with .929 in increased belief, and .874 in fixed belief.

2.2.3 Task Persistence Tendency
This study evaluated task persistence tendency in the PE class using the four question items about task persistence behavior developed by and adapted by to use targeting a middle school student. Also, this study composed the questionnaire response pattern with the 5-point Likert scale, and the reliability coefficient of task persistence was found to be .901, showing a stable numerical value.

2.3 Research Procedures
This study conducted the survey of this research in keeping with the fixed survey schedule by school after the person in charge of the research directly explained the purport and purpose of the research to the teacher-head of the PE department at the four middle schools. Next, upon the responsibility of the head of the PE department by school, the responsible PE teacher by grade conducted the survey after explaining the purpose of this research and questionnaire completion guide in detail to students prior to the PE class.

In addition, this study specified it in the consent to research that this study wouldn't use a student's personal information collected through the survey other than the research purpose, and that a student could participate in the survey on one's free will, and withdraw the survey in case a student didn't want to do. It took about ten to fifteen minutes to complete the questionnaire according to students, and this study immediately collected it as soon as they completed the responses to the questionnaire. This study used the data of 418 copies collected through such a procedure for final analysis after examining unfaithful data like non-response data (including an omission of the response to 1 question item by each scale), and missing value.

2.4 Data Analysis Method
With the final data of 418 copies of questionnaires, this study conducted the confirmatory factor analysis in Maximum Likelihood for confirming concept reliability and discriminant validity of the measurement model in a bid to grasp general characteristics of the research subjects using SPSS 18.0 and AMOS 18.0. Also, for hypothesis testing, this study conducted the structural equation model analysis and verified the mediated effect analysis through the bootstrapping method. This study evaluated the goodness of fit of the measurement model and structural model through $X^2$, TLI, CFI, RMSEA, and all statistical significance was verified at a level of $\alpha=.05$. Its concrete analysis procedures are as follows:
2.4.1 Measurement Model Verification

It’s necessary to preferentially verify whether measurement model is valid before doing structural model verification\(^26\). The valid measurement model means that a construct is independent in case each latent variable well explains an observed variable and the correlation between latent variables is not very high. As the estimation method of the measurement model, this study applied Maximum Likelihood and applied it to structural model testing in the same way.

This study used TLI, CFI, and RMSEA as a goodness-of-fit index for fit judgment of a model. These indexes are the recommended ones because they consider goodness of fit & simplicity of a model (CFI doesn’t consider simplicity) while not being much influenced by sample size\(^26\). The goodness-of-fit criterion of indexes can be interpreted as an acceptable level in case TLI and CFI are more than .90 values and RMSEA is under .80 value\(^22\), this study also applied to structural model testing in the same way.

3.2 Structural Model Testing and Mediated Effect through Bootstrap

To verify the structural model, this study did modeling of structural relations, in which learning environment perceived based on the preceding researches was set as an exogenous variable, and athletic ability beliefs and task persistence were set as endogenous variables. Also, to verify the mediated effect of athletic ability beliefs in the relations between perceived learning environment and task persistence, this study confirmed it by applying the Bootstrap method\(^22\). According to\(^22\) verification of mediated effect is meaningful when the path between independent variables and mediator variables and between mediator variables and dependent variables is significant in constraint model. Accordingly, goodness of fit of the structural model of this study was fixed as an acceptable model, and consequently this study verified significance of indirect effect through bootstrapping based on the procedures suggested by\(^28\).

3. Results

3.1 Measurement Model Evaluation

This study obtained the result like (Table 1) by conducting the confirmatory factor analysis for verifying convergent validity and discriminant validity of overall research units. Also, for substantial analysis, this study evaluated goodness of fit using Maximum Likelihood: ML supposing multi-variate normality. As a result, goodness of fit was found to be \(X^2=1110.313, df=308, Q=3.605, TLI=.884, CFI=.946, RMSEA=.071\), showing that general goodness of fit failed to meet the general standard.

Accordingly, this study sorted out question items on the basis of absolute value \(\pm 1.96\) by confirming the standardized residuals value between individual question items in order to construct accurate model measurement of the measurement model. Also, as a result of confirming the square(d) value of multi-correlation of individual observed variables, 1 question item for effort/challenge, 1 question item for increased beliefs, and 2 question items for measuring fixed beliefs were found to be deleted.

The result of the confirmatory factor analysis of measurement model excluding the deleted question items was found to be \(X^2=587.996, df=214, Q=3.605, TLI=.936, CFI=.880, RMSEA=.071\), showing somewhat good aspects; thus, this study confirmed that the measurement model was an acceptable one.

In addition, to verify convergent validity, this study made a comparison between construct reliability, average variance extracted (AVE) value, and standard loading. As a result, construct reliability was found to be from .880 to .967, meeting the criteria (above .7), and AVE value also met the criteria (above .5) covering from .622 to .880, securing its reliability. Individual observed variables showed coefficients from .622 to .950, so this study confirmed there existed convergent validity because general construct reliability and AVE value were found to be good as well. Also, the correlation between 6 variables was found to be less than .80, showing a low possibility of existence of multi linearity in the relations between observed variables; consequently, this study confirmed that observed variables had the relationship suited for implementing confirmatory factor analysis. Detailed results are suggested in Table 1.

3.2 Structural model Evaluation

Now that reliability and validity of measurement model were secured, this study evaluated a hypothetical study model as Step 2. As a result of conducting the structural equation model analysis, the goodness of fit of the model was found to be fit for a structural model with \(X^2=589.483, df=215, Q=2.742, TLI=.936, CFI=.946, RMSEA=.071\). As a result of confirming the size and direction of each direct path, it was found that 6 paths
among 11 paths in all were significant (P<.01) as suggested in Table 2.

### Table 2. Structural model path

<table>
<thead>
<tr>
<th>Path</th>
<th>Estimate (Estim)</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effort &amp; Challenge perception → Increased beliefs</td>
<td>.356</td>
<td>.061</td>
<td>5.806</td>
<td>***</td>
<td>Adoption</td>
</tr>
<tr>
<td>Effort &amp; Challenge perception → Fixed beliefs</td>
<td>.190</td>
<td>.099</td>
<td>1.922</td>
<td>.055</td>
<td>dismissed</td>
</tr>
<tr>
<td>Competency perception → Increased beliefs</td>
<td>.016</td>
<td>.060</td>
<td>.269</td>
<td>.788</td>
<td>dismissed</td>
</tr>
<tr>
<td>Competency perception → Fixed beliefs</td>
<td>-.483</td>
<td>.105</td>
<td>-4.601</td>
<td>***</td>
<td>Adoption</td>
</tr>
<tr>
<td>Threat perception → Increased beliefs</td>
<td>.007</td>
<td>.047</td>
<td>.154</td>
<td>.877</td>
<td>dismissed</td>
</tr>
<tr>
<td>Threat perception → Fixed beliefs</td>
<td>.199</td>
<td>.081</td>
<td>2.471</td>
<td>.013*</td>
<td>Adoption</td>
</tr>
<tr>
<td>Increased beliefs → Task persistence</td>
<td>.447</td>
<td>.065</td>
<td>6.919</td>
<td>***</td>
<td>Adoption</td>
</tr>
</tbody>
</table>

### 3.3 Mediated Effect

This study verified the significance of indirect effect through bootstrapping according to the procedures suggested by because the model was the one which could be accepted by goodness of fit of the structural model of this research. The bootstrapping method is the one which estimates the standard error of indirect effect, which could appear in mediated effect verification, and in case confidence interval is suggested, and the interval doesn't include '0', this method regards indirect effect as statistically significant. This study set the number of times of repetitions estimation as 2,000 and verified its significance by a 95 percent confidence interval.
As a result of analysis, indirect effect was found to be statistically significant because Lower Bounds value and Upper Bounds value didn’t include ‘0’ on the path of ‘Effort & Challenge perception → Increased beliefs → Task persistence’. The detailed results of mediated effect analysis through bootstrapping are suggested in Table 3.

### 4. Discussion

This research was carried out with the aim of analyzing the structural relations between students-perceived PE learning environment, athletic ability beliefs and task persistence in the PE class situation, and the discussion based on drawn results is as follows:

First, effort & challenge perception in PE learning environment was confirmed to have a positive influence on increased beliefs while competence perception was found to have a negative influence on fixed beliefs (entity belief), and threat perception was found to have a positive influence on entity belief.

Such results back up the existing research results that a student, who perceived effort and challenging environment, can have a high belief that athletic ability increases through learning and effort, by virtue of his/her internal interest and positive emotional experience. In contrast, the results support the preceding research which reported that threatening environment causes a student to fail to feel interested in the PE class, or lowers a student’s will to participate in the PE class. Accordingly, teachers in charge of the PE class are advised to put their focus on providing a challenging task in the form suited for students’ level, and to induce them to be able to improve their own positive athletic ability through the situation where they can perceive their ability other than a threatening mood, and feedback.

Second, it was found that increased beliefs in athletic ability beliefs had a significant influence on task persistence positively while entity belief didn’t have a significant influence on task persistence. It might be safe to say that such a result substantiates the result that students having increased beliefs, i.e. the students, who think that an athletic ability could be improved through effort, show a more aggressive class behavior than the students having entity belief, and the result is the one which coincides with most of the preceding researches which addressed the belief in an ability and class behavior.

Also, In and reported that the more a student has increased beliefs, the more the student tends to show learning (task) objective setting, positive emotion, and effective problem-solving, etc., whereas a student, who has entity belief, quite tends to show performance (self) objective setting, negative emotion and maladjusted motive and attitude, etc. In the light of such a result, the positive belief that athletic ability improves by virtue of learning and effort was confirmed to be as an influential variable in explaining task persistence which is an aggressive class behavior. It might be because the higher the belief that it’s possible to improve an athletic ability by learning and effort in carrying out an athletic task assigned in the PE class, the more a student can promote his/her intrinsic motivation to steadily persist a task.

Third, it was found that effort, challenge perception, and competence perception of learning environment had a positive influence on task persistence. Such a result also coincides with the research which recently reported at home, which features the result that effort & challenge perception environment has a significant influence on students’ effort and persistence behavior, supporting this research result; also, the research shows the result corresponding to this research result that effort and challenging environment arouses students’ aggressive class behavior.

Also, even in the preceding researches reported at home and abroad all this while, they reported that it might be possible to increase students’ internal motive as
well in the PE class by providing students with competency information and environment, such as a teacher's compliments or feedback, challenging task, and vicarious experience, etc., and that behavioral & emotional effect could be expected later. As appears by such results, a teacher in charge of the PE class is supposed to create the class environment which makes it possible for students to have a spirit of challenge, and to perceive competency by making much of learning process rather than a pursuit of learning result in creating the PE class environment. In addition, such a class environment will contribute to fostering the continued propensity to participate with effort and interest by inducing students to manifest improvement of task and up skill-centered behavior.

Lastly, it was confirmed that increased beliefs in the relations between effort, challenge perception and task persistence of learning environment play a mediating role. Although it's difficult to make a direct comparison due to the non-existence of the result of the preceding researches on the same variables, which this research brought in, a number of researches performed from the ecological perspective recently are consistently reporting that learning environment perception has an influence on students' motive and behavior, and could accelerate or obstruct their physical activity.\textsuperscript{5,6,8,9}

These researches are taking an ecological standpoint to understand the behavior consequent on physical activity. Such an ecological standpoint considers physical activity behavior as being influenced by interactions between environmental aspects and an individual's psychological elements.\textsuperscript{29} It can be learned that the learning environment perceived this way has a direct, indirect influence on motives and physical activity level. Such a fact is implying that it might be possible to arouse a continued, aggressive class behavior by perceiving & displaying personal competency when students are provided with the learning environment which is challenging and makes it possible for students to put in a great deal of effort by selecting a task fit for students' level.

### 5. Conclusion and Suggestions

This research confirmed the results as follows by analyzing the structural relations between the learning environment perceived by junior high school students, athletic ability beliefs, and task persistence, and verifying the mediated effect of ability beliefs in the relations between learning environment and task persistence.

First, effort and challenge perception in PE learning environment was confirmed to have a positive influence on increased beliefs while competence perception was found to have a negative influence on fixed beliefs and threat perception was found to have a positive influence on entity belief. Second, it was found that increased beliefs in athletic ability beliefs had a significant influence on task persistence positively while entity belief didn't have a significant influence on task persistence. Third, it was found that effort, challenge perception, and competence perception of learning environment had a positive influence on task persistence. Lastly, it was confirmed that increased beliefs in the relations between effort, challenge perception and task persistence of learning environment play a mediating role.

In Physical Education class, there come to pass an occurrence of diverse cognitive factors and exploratory behavior because physical activity takes place in an external environment, such as a classroom, playground, and gymnasium, etc. Particularly, Physical Education class requires tasks, teaching method, personal athletic ability, fairness, intimacy between a teacher and a student, and equipment, etc. Accordingly, the class behavior intending to aggressively participate in goal achievement, and task performance becomes feasible when equipped is the class environment that makes it possible for students to have the will to perform tasks spontaneously.

Conclusively, this study confirmed that students' aggressive class participation behavior calls for the learning environment, which is challenging, and makes it possible for students to put in a great deal of effort for their learning process, and a positive belief and volition that students themselves can do it in the results of this research. Also, this research was done by confining itself to the psychological learning environment about continued participation behavior, so it is required that the hereafter researches should deal with the integrated analysis of diverse psychological factors, and social factors which could be directly or indirectly involved in an aggressive, active task participation behavior.

### 6. References


31. Shafizadeh M. Relationships between goal orientation, motivational climate and perceived ability with intrinsic motivation and performance in physical education.


