Physical education in Taiwan: when students begin to take control

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Abstract

The aim of this study was to investigate the effect on self-regulated learning (SRL) of a physical education (PE) pedagogy based on Zimmerman's (2000) model of SRL by means of an 8-week PE curriculum intervention in Taiwan. Participants were 632 Taiwanese students (aged 13.9 ±0.3 years; 28 PE classes) and a wait list control class (n = 21; aged 14.1 ±0.2 years). Constructs from the Intrinsic Motivation Inventory, the Motivated Strategies for Learning Questionnaire, and the Five Component Scale for Self-Regulation were measured pre-and post the intervention by means of on an online survey platform. Multiple repeated measures ANOVAs were used to determine if there were any significant differences pre- and post the intervention and any interaction effects between the intervention and the control. The classes who participated in the intervention showed relatively small mean increases in enjoyment, perceived competence, intrinsic value, self-efficacy, cognitive strategy use, goal setting, strategy implementation and strategy monitoring. In contrast for the control class, eight out of the eleven factors showed relatively larger negative changes in scores. These data indicate that with this sample the benefits of adopting a self-regulated learning approach in PE lessons over an 8-week period appeared to be more about maintenance of the stability of these personal characteristics rather than the enhancement of them.

Keywords: Taiwan, Self-regulated Learning, Physical Education, Pedagogy.

Introduction

In 'western' societies school disengagement and dropout are major concerns along with growing sedentariness among youth (Janssen, 2012; Moffit et al., 2011). Chinese

based societies have traditionally been known for adopting psychologically controlling styles of interaction with children and youth (Ng et al., 2014). Research has shown that Asian learners who perceive a lack of autonomy-supportive educational contexts display poorer time management and more distraction (Vansteenkiste et al., 2005) and the more children experience psychologically controlling environments the more they are likely to suffer emotionally and academically (Wang et al., 2007). Chinese society has also been described as 'masculine' (such as in an emphasis on competition in preparation for the job market) and promoting 'interdependence'. Thus parents' 'have most face' when their children are successful in their academic performance (Hwang, 2006) i.e. and as such are heavily focused on individual performance in comparison to others.

According to achievement goal theory (AGT) (Nichols, 1984, 1989) individuals feel successful when striving to advance their ability (mastery orientation) or when demonstrating their competence relative to others (performance orientation). Furthermore, AGT assumes that goal orientations are a function of the context, and in particular, the perceived motivational climate. A performance oriented climate emphasizes interpersonal competition and social comparison (Ames, 1992), and has been related to less self-determined motivation (Parish and Treasure, 2003), poorer performance, and effort withdrawal (Nerstad et al., 2013). This is interesting because a recent study found that approximately 43% of variance in effort lies at the intrapersonal level and it appears that the degree to which an adolescent is autonomously motivated can explain why she or he may persist more (Mouratidis and Lens, 2015). Although mastery and performance climates are considered independent dimensions of the perceived motivational climate, it is possible that mastery and performance climates interact to affect motivation and behavior. Therefore, the motivational climate can create, restrict, enhance, differentiate, and equalize educational opportunities for individuals, and their relative success or failure will be mediated through the impact of policy and pedagogical practice at the intrapersonal level.

Individuals can be motivated for different reasons and self-determination theory facilitates an understanding of the why (i.e. process) and what (i.e. content) of goal pursuit (Deci and Ryan, 2000). For example, intrinsically motivated individuals engage in Physical Education (PE) because they derive feelings of pleasure and satisfaction directly from participation (i.e. non-instrumentally focused) and individuals who are more extrinsically motivated engage in PE because their motivation is dependent on and focused toward contingent outcomes which can be separated from the action itself (Ryan and Deci, 2002). In educational settings it is argued intrinsic motivation is based in human needs to be self-determined, competent and related to others, and is facilitated by contextual conditions conducive to autonomy. For example, the inclusion of students in decision-making processes facilitates the satisfaction of the need for autonomy in activity settings (Roberts, 2012; Sproule et al., 2013), and is more likely to make students' perceptions of their competence more resilient in PE (Standage et al., 2005), thereby supporting a positive relationship between mastery climate and self-determined motivation (Moreno et al., 2010). In contrast, a performance climate can be perceived as more controlling (i.e. perceived locus of causality) which is more likely to reduce feelings of autonomy (Deci and Ryan, p.8). It has been argued that to remain on task and engaged in the classroom, children require good self-regulation skills (Blair and Razza, 2007).

Further, children showing a high level of physical aggression, impulsivity and emotional distress are likely to have poor self-regulation skills (Blair and Diamond, 2008).

Self-regulated learning. Grounded in social cognitive theory, self-regulated learning (SRL) is a theoretical approach attending to processes "whereby learners personally activate and sustain cognitions, affects and behaviors that are systematically oriented toward the attainment of personal goals (Zimmerman and Schunk, 2011, p.1). Probably the most-quoted definition of SRL stems from Schunk and Zimmerman (1994): (the learners') "…..self-generated thoughts, feelings, and actions which are systematically oriented toward the attainment of their goals." Self-regulation is seen as an inclusive approach to student learning, and self-regulated learning includes cognitive (e.g. decision-making) performance (e.g. self-observation) and reflective (self-evaluation) elements (Zimmerman, 2000 and 2008). This assumes learners employ agency through active control and monitoring of their learning (Winne and Hadwin, 20 08). It is considered essential that curriculum is structured in a manner that scaffolds motivational aspects of SRL (Egan, 2011). Thus, "although autonomous self-regulation is the destination, the road goes through social regulation, reflecting the ancient Chinese proverb, *Start with your master, end with yourself* (Reeve et al., 2008, p.239)". Unfortunately some PE teachers seem to have a lack of knowledge of SRL and they neglect teaching their students *how* to self-regulate (Dignath-van Ewijk and van der Werf, 2012; Perry et al., 2008). Recently, Piche, Fitzpatrick and Pagani (2015) suggested there was a reciprocal positive association between self-regulation skills and structured physical activity. They highlighted that early participation in structured sports (team sports in particular) from the age of 5 years facilitated the development of self-regulation skills, such as effortful, goal-directed, and self-discipline behavior, at 10 years of age.

Zimmerman (2000) suggested a four-level model for the development of self-regulation and, based on this model Goudas, Kolovelonis, and Dermitzaki (2013) proposed an instructional approach of teaching PE. According to this approach, learning a new skill begins with observational learning. Students then practice the skill receiving social feedback from their physical educator or from their peers. As students' progress in mastering the skill, social feedback is gradually withdrawn and replaced by self-generating feedback. Finally, depending on the type of the skill, students should either practise the skill in changing conditions to develop their competence to perform the skill in changing environments or, in the case of skills performed in closed environments, practise the skill to further develop automaticity. Goudas et al. (2013) suggested that Physical Educators could use this instructional approach to help their students become self-regulated learners, as well as individualize teaching and learning in PE. Thus, within a PE class, students may practise a skill at different levels of self- regulation. However, further evidence regarding the effectiveness of this model is needed. Therefore the purpose of this study was investigate the effect on SRL of a PE pedagogy based on Zimmerman's 4 level model of SRL in a Chinese based society.

Methods

Participants. This study followed a quasi-experimental design. Twenty-eight (17 male; 11 female; mean age 22.4 ±1.1. years) year 3 undergraduate (Hons) Asian

(Taiwan) PE students were first recruited as student teachers for the project. Three Junior High Schools (JHS) in Taiwan, associated with the practicum experiences of Taiwanese PE students, then agreed to facilitate this research within their weekly PE lessons. This involved 28 PE classes and 632 students (aged 13.9 ±0.3 years). A fourth JHS provided an 8-week waiting list control class (n = 21; aged 14.1 ±0.2 years) i.e. they would receive access to the curriculum intervention after 8 weeks. Prior to the commencement of the project, ethical approval was sought and granted from the University's ethics committee and, prior to data collection, consent was obtained from all concerned.

The number of participants in the control group is considerably underweighted and is acknowledged as a limitation. The practicalities of recruiting schools willing to act as a control proved to be problematic. The schools approached by the research team were only willing to act as control groups if they were able to access the curriculum intervention after 8-weeks. The practicalities and logistics associated with this process meant that only two JHS were able to act as controls. Unfortunately one of these control schools had to drop out later due to unforeseen circumstances.

Scheme of work. The PE curriculum in Taiwan has strong foundations in activities such as basketball and badminton. As the focus of this study was on the pedagogy it was decided to plan for different activities each week within the 8-week curriculum intervention i.e. to test the pedagogical approach without being confounded by any specific activity. Additionally, the activities covered in each lesson had not been previously experienced by students during their PE lessons. Therefore it was decided that the intervention would be scaffolded around activities such as orienteering and rugby.

Lesson planning. Weekly PE curriculum lessons were planned by the principal researcher across an 8-week period for the three intervention JHS. This involved considerable discussion and negotiation with the PE teachers in the partner schools throughout the 8-weeks. The application of Zimmerman's (2000) 4 level model for SRL, involved proceeding sequentially in lesson planning, such as:

1. observational learning (e.g. verbal instructions/visual demonstrations);
2. emulation (e.g. practise skills with social feedback from the PE teacher or/and from peers e.g. reciprocal style of teaching);
3. self-control/self-generating feedback (e.g. social feedback was gradually withdrawn e.g. self-direct their practice – setting own goals – self-monitoring own performance – using self-control techniques such as self-talk to enhance performance e.g. self-check teaching style);
4. self-regulation (e.g. practise skills in changing environments to develop competence re open skills or practise skills to further develop automaticity in the case of skills performed in closed environments – and using self-reflection/self-judgement to assess/monitor own progress and goal set for the next lesson).

Thus, a linear model of observation → emulation → self-control → self regulation was central to this pedagogical approach to promote self-regulated learning and positively impact on the motivational climate of the PE lesson. On a weekly basis the lead researcher, with 40 years of PE pedagogy experience (practical and research based) conducted SRL activity workshops with and taught each planned SRL PE lesson to the PE students prior to the students delivering the lesson to the JHS students in their schools. The teachers of the control group also received in-service workshops

to enable them to deliver the same curriculum intervention following the 8-week intervention period.

Variables measured. Constructs from the Intrinsic Motivation Inventory (IMI), the Motivated Strategies for Learning Questionnaire (MSLQ), and the Five Component Scale for Self-Regulation [FCSSR]) provided the variables measured in this study. Three subscales of the Intrinsic Motivation Inventory (Ryan & Deci, 2000), a multidimensional measurement device intended to assess participants' subjective experience related to an activity, were used - *enjoyment, perceived competence, and effort.* Four items were used to measure 'enjoyment' (e.g., I think PE is very interesting). Four items were used to measure 'effort' (e.g., I do my best in PE). Five items were used to measure perceived competence (e.g., I think I am good at PE). Answers for these items were given on a seven-point Likert-scale ranging from 1 (not at all true) to 7 (very true). The IMI has been used in several experiments related to intrinsic motivation and self-regulation and has demonstrated good psychometric properties (McAuley, Duncan & Tammen, 1989; Vos, van de Meijden & Denessen, 2011).

The Motivated Strategies for Learning Questionnaire (MSLQ) is a self-report instrument designed to measure students' motivational orientations and their use of different learning strategies (Pintrich et al., 1991). The MSLQ has been used extensively in Western settings (e.g. Cheang, 2009) and it has been highlighted that the Chinese learner has different characteristics. Whereas Western culture encourages metacognitive strategies for learning (Rao and Sachs, 1999), students from Chinese society tend to learn by rote learning (Law et al., 2008). Liu et al. (2012) and Ng et al. (2015) investigated the psychometric properties of a modified (28-item) MSLQ on secondary school students in Singapore and their findings supported the reliability and validity of the 28-item MSLQ in the Asian cultural context. This version was used in this study, including the subscales: *intrinsic value* (5 items; e.g., I like what I am learning in this class), *self-efficacy* (6 items; e.g., I think I will receive a good grade in this class), *anxiety* (4 items; e.g., I have an uneasy, upset feeling when I take a test), *learning strategies* (10 items; e.g., Before I begin I think about the things I will need to do to learn), *lack of self-regulation* (3 items; e.g., I find that when the teacher is talking I think of other things and don't really listen to what is being said). Answers for these items were given on a seven-point Likert-scale ranging from 1 (not at all true) to 7 (very true).

Finally, MacLellan and Soden's (2006) modified version of the Five Component Scale for Self-Regulation – FCSSR (Martinez-Pons, 2000) was also included in this study because it focuses on the environmental context students are learning in and has demonstrated good psychometric properties. It consists of three subscales: *goal setting, using strategies,* and *strategy monitoring*. Eleven items were used to measure 'goal setting' (e.g., When doing PE, I always set goals to guide me in my efforts). Eleven items were used to measure 'strategy implementation' (e.g., I take notes during class). Eleven items were used to measure 'strategy monitoring (e.g., I compare the strategy to other strategies to see which is more effective). Answers for these items were given on a four-point Likert-scale ranging from 1 (never) to 4 (all the time).

These constructs comprised the survey which was loaded onto an online platform (Bristol Online Surveys) in the Mandarin Chinese language. For the translation, an iterative process of revision (English to Mandarin Chinese language) was undertaken by the lead researcher in consultation with a Taiwanese JHS Principal in Tainan, three Mandarin Chinese language teachers based in Scotland (from China,

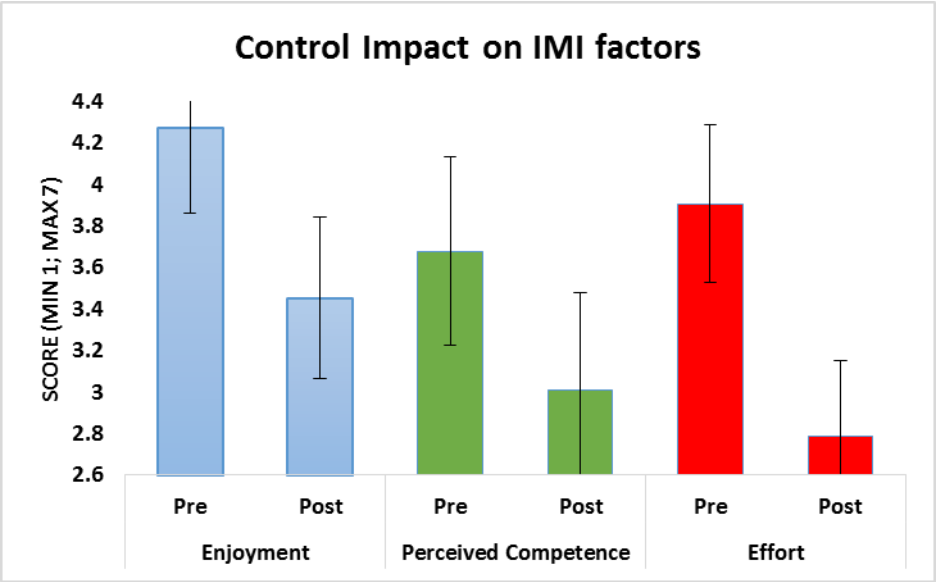
Singapore & Taiwan), one Taiwanese based university PE lecturer, and two Mandarin Chinese language postgraduate students (from Taichung and Taipei) across a three month period (January-March 2015). Prior to implementation, a pilot survey was conducted to test the survey. This included on-line pilot testing with 100 JHS students (aged 12 – 15 years) based in Taiwan. This resulted in minor modifications and refinements and an average completion time of just under 10 minutes. Confidentiality was guaranteed to survey questions and all JHS students were advised that it was their right to stop the survey at any point and that they could choose not to answer a question if they felt uncomfortable doing so.

Statistical analysis. Statistical data analyses were carried out using IBM Statistical Package for the Social Sciences Version 20 (SPSS 20) software for Windows. Multiple repeated measures ANOVAs were used to determine if there were significant differences in the groups' scores pre-and post the intervention period and any differences between the groups in the changes observed over time.

Results

Baseline. There were no significant differences at baseline between the intervention and control groups for enjoyment ($F(627,1) = 3.095$; $P>0.05$; $\eta p2 = .005$); perceived competence ($F(627,1) = 1.327$; $P>0.05$; $\eta p2 = .002$); effort ($F(627,1) = 2.124$; $P>0.05$; $\eta p2 = .004$); anxiety ($F(627,1) = .005$; $P>0.05$; $\eta p2 = .000$); and lack of self-regulation ($F(627,1) = 3.328E-006$; $P>.05$; $\eta p2 = .000$). However, there were significant differences at baseline between the intervention and control groups for intrinsic value (intervention 3.38; control 3.96 - $F(627,1) = 8.450$; $P=.003$; $\eta p2 = .014$); self-efficacy (intervention 3.29; control 3.76 - $F(627,1) = 5.670$; $P=.013$; $\eta p2 = .010$); learning strategies (intervention 3.23; control 3.75 - $F(627,1) = 7.088$; $P=.006$; $\eta p2 = .012$); goal setting (intervention 2.45; control 2.84 - $F(627,1) = 3.874$; $P=.005$; $\eta p2 = .012$); using strategies (intervention 2.68; control 3.11 - $F(627,1) = 4.748$; $P=.004$; $\eta p2 = .013$); and strategy monitoring (intervention 2.59; control 2.92 - $F(627,1) = 2.876$; $P=.029$; $\eta p2 = .008$).

Intrinsic motivation variables. There were significant differences across time for enjoyment ($F(642,1) = 7.920$; $P<0.05$; $\eta p2 = .012$; and effort ($F(642,1) = 18.547$; $P<0.05$; $\eta p2 = .028$); but not perceived competence ($F(643,1) = 3.745$; $P>0.05$; $\eta p2 = .006$). Figure 1 shows that there was difference in the size and direction of the changes experienced by the two groups. For the intervention group, there was a relatively small increase in scores for enjoyment and perceived competence, and a similar decrease in the scores for effort. In comparison, the control group showed relatively larger reductions in scores for enjoyment, perceived competence and effort.



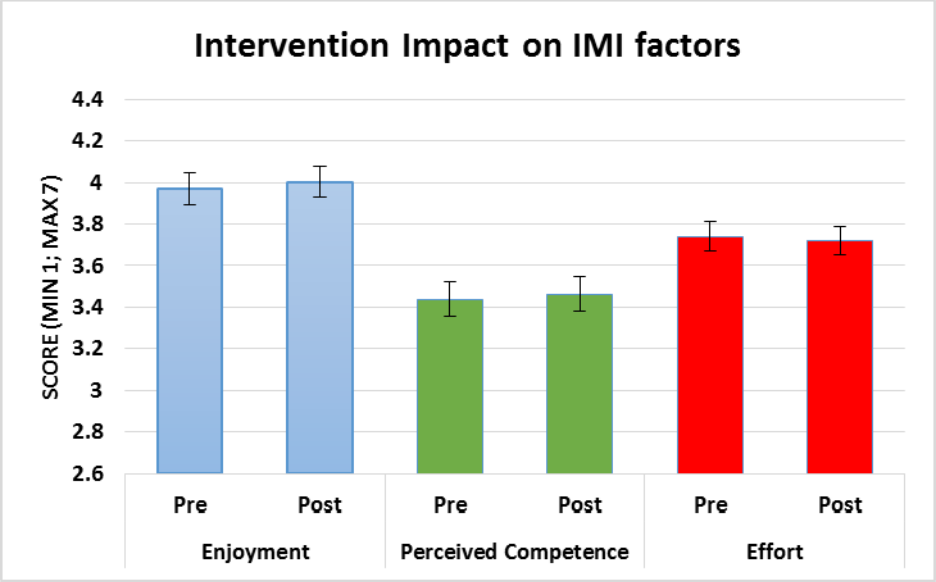


Figure 1. Mean pre-and post-scores for enjoyment, perceived competence, and effort for intervention and control groups. There were significant interaction effects between time and groups for all three variables P<.05.

Significant interaction effects between the groups over time were revealed for all three factors, enjoyment ($F(642,1) = 9.346$; $P<0.05$; $\eta p2 = .014$; effort ($F(642,1) = 16.703$; $P<0.05$; $\eta p2 = .025$); and perceived competence ($F(643,1) = 4.275$; $P<0.05$; $\eta p2 = .007$).

Strategies for Learning. With regards to the Motivated Strategies for Learning Questionnaire, a similar pattern can be observed for the variables intrinsic value ($F(637,1) = 6.133$: $P<0.05$; $\eta p2 = .01$); self-efficacy ($F(636,1) = 4.387$: $P<0.05$; $\eta p2 = .007$); and cognitive strategy use ($F(638,1) = 7.146$: $P<0.05$; $\eta p2 = .011$) which were all significantly different across time. These variables displayed small increases for the intervention group and quite large declines for the control group. Lack of self-regulation ($F(636,1) = 13.385$: $P<0.05$; $\eta p2 = .021$); and test anxiety ($F(636,1) =$

11.464: P<0.05; ηp2 = .018) also showed a significant difference over time but in the case of these variables although the pattern for the intervention group was similar, the direction of change is reversed to a large increase in scores for the control group. The interaction effects were all significant being: intrinsic value (F(637,1) = 9.980: P<0.05; ηp2 = .015); self-efficacy (F(636,1) = 6.397: P<0.05; ηp2 = .01); cognitive strategy use (F(638,1) = 8.872: P<0.05; ηp2 = .014); lack of self-regulation (F(636,1) = 11.150: P<0.05; ηp2 = .017); and test anxiety (F(636,1) = 8.385: P<0.05; ηp2 = .013). Figure 2 shows the intervention appeared to reverse the negative effects on intrinsic value, self-efficacy and cognitive strategy use experienced by the control group and 'soften' the negative effect of lack of self-regulation and test anxiety that occurred across the period of the intervention for the control group.

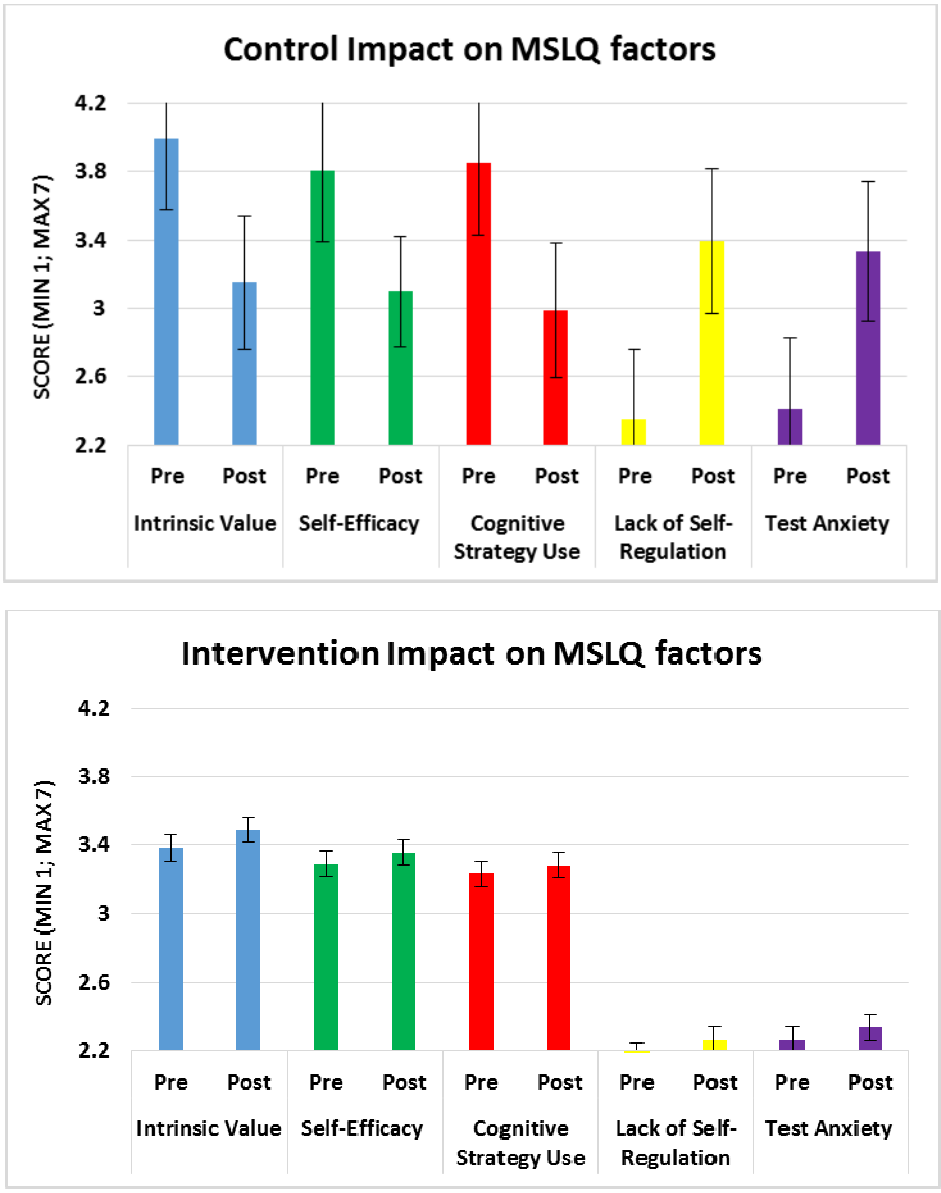
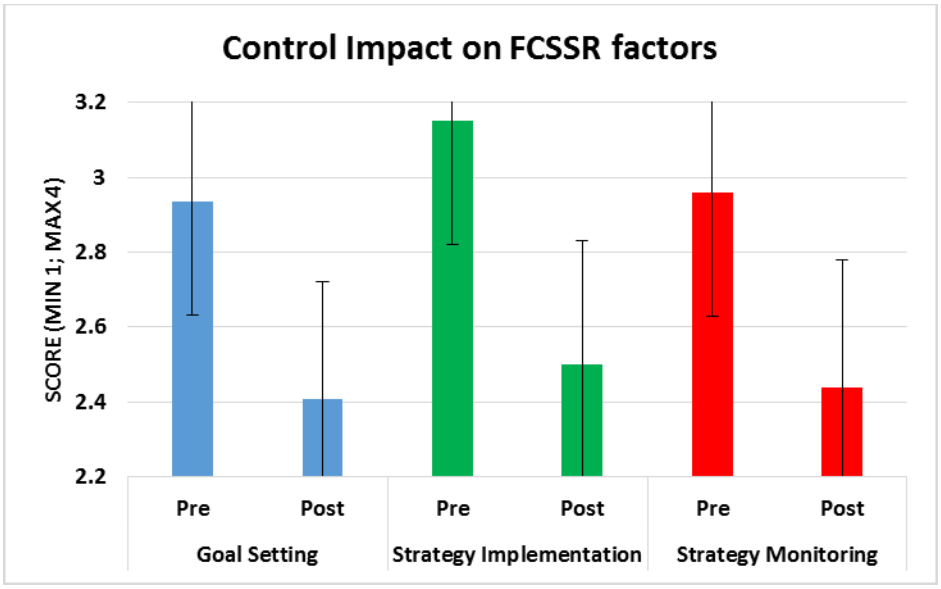


Figure 2. Mean pre and post scores for intrinsic value, self-efficacy, cognitive strategy use, lack of self-regulation, and test anxiety for intervention and control groups. There were significant interaction effects between time and groups for all five variables P<.05.

Strategies for self-regulation. The same pattern was observed for both groups with regards to the variables measured by the Five-Component Scale of Self-Regulation Scale. There were significant differences across time for goal setting ($F(637,1) = 5.082$: $P<0.05$; $\eta p2 = .008$); strategy implementation ($F(623,1) = 7.165$: $P<0.05$; $\eta p2 = .011$); although not strategy monitoring ($F(619,1) = 3.482$: $P>0.05$; $\eta p2 = .006$). Significant interaction effects for the groups over time were found for each factor, goal setting ($F(637,1) = 6.434$: $P<0.05$; $\eta p2 = .01$); strategy implementation ($F(623,1) = 8.224$: $P<0.05$; $\eta p2 = .013$); and strategy monitoring ($F(619,1) = 6.050$: $P<0.05$; $\eta p2 = .01$).



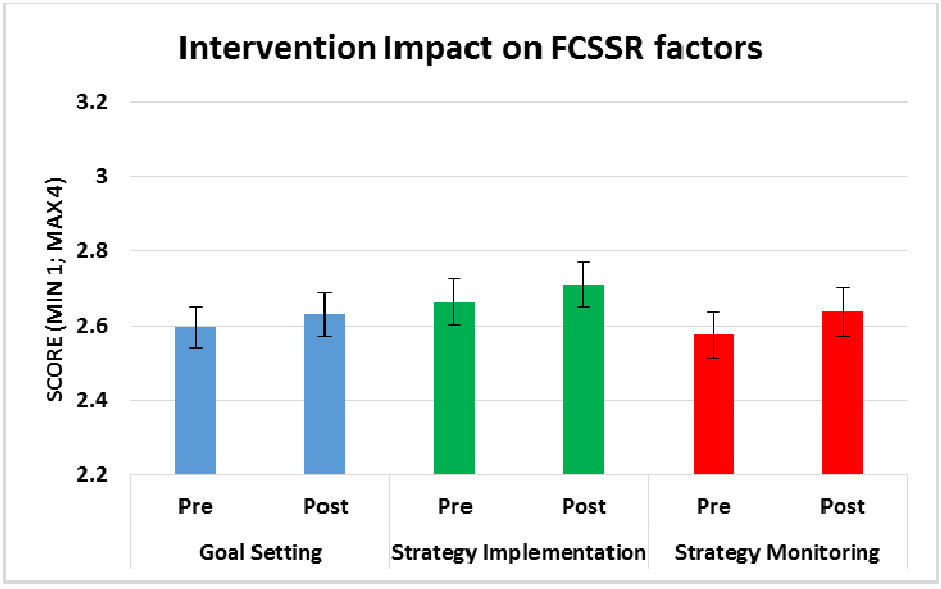


Figure 3. Mean pre-and post scores for goal setting, strategy implementation and strategy monitoring for intervention and control groups. There were significant interaction effects between time and groups for all three variables $P<.05$.

Discussion

The study revealed significant changes in most of the motivational and learning variables factors examined for the period of the intervention for both the control and intervention groups. The exceptions were perceived competence and strategy monitoring. Specifically, over time the intervention group showed relatively small mean increases in enjoyment (+0.03), perceived competence (+0.02), intrinsic value (+0.11), self-efficacy (+0.07), cognitive strategy use (+0.05), goal setting (+0.02), strategy implementation (+0.05) and strategy monitoring (+0.06). and small changes in a negative direction for the means for effort (-0.02), lack of self-regulation (+0.1) and test anxiety (+0.07). This was in sharp contrast to the control group, where for eight out of the eleven factors, there were relatively larger negative, as opposed to smaller positive changes in scores. For example, changes in the means for enjoyment (-0.81), perceived competence (-0.67), intrinsic value (-0.84), self-efficacy (-0.71), cognitive strategy use (-0.86), goal setting (-0.53), strategy implementation (-0.65) and strategy monitoring (-0.52). For the remaining three factors, while not showing any beneficial increase, membership of the intervention group nonetheless was associated with only a small shift in a negative direction and thus it appeared to mediate the decline that was demonstrated in the control group. Changes across time for the control group were - effort (-1.12), lack of self-regulation (+1.05) and test anxiety (+0.92). Therefore, these data are indicating the benefits of adopting a self-regulated learning approach in these PE lessons week period appeared to be more about ensuring the stability of these motivational and learning characteristics rather than enhancing them.

Effortful behavior as a measure of classroom engagement is consistent with current theory of self-regulation in terms of its cognitive, emotional and behavioral dimensions (Blair and Razza, 2007). In our study although we found no significant increase in effort by the intervention group, a significant reduction in effort was seen for the control group. A plausible interpretation of this is that the intervention facilitated the maintenance of effort across the 8-week intervention, and this warrants further investigation. It has previously been shown that the application of self-regulatory skills can facilitate learning and performance in PE (Ommundsen and Lemyre, 2007), and that self-regulation skills and disposition toward physical activity, via participation in structured extra-curricular sport (particularly team sport), have a positive, reciprocal relationship, where one enhances the other in children (Piche et al., 2015). Self-regulated learning involves affective, motivational, cognitive and metacognitive experiences, and forms of metacognitive experiences include metacognitive feelings (e.g. feelings of difficulty) and metacognitive estimates such as estimations of effort (expenditure). Estimate of effort is mainly influenced by feelings of difficulty i.e. feelings of difficulty can inform students if additional effort is needed (Efklides, 2009). Recently Goudas et al. (2015) investigated the effects of teaching a basketball skill through a self-regulated learning approach during two consecutive 6-minute learning episodes on students' metacognitive feelings of effort *during* a PE lesson. They found that students reported higher feelings of effort having had the actual experience of the practice of the basketball skill. (i.e. pre-estimate to post experience of the basketball practice). If one of the hallmarks of a physically literate individual is that they value effort (Dudley, 2015) this is interesting and important because students' metacognitive feelings of effort could be used to differentiate needs of individual students to help them learn at their own pace, and this warrants further study across PE lessons as well as within lesson episodes.

The findings of the present study while far from conclusive suggest there may be potential in a self-regulated learning pedagogical model for enhanced student learning and engagement in PE in Taiwan. Constructivist learning theory (both social and cognitive constructivism) lends support to a shift in the paradigm of pedagogy toward higher level thinking, reflective and adaptive processes for enhanced learner engagement, as a responsible citizen, with progressively more complex and encompassing concepts and applications beyond psychomotor performance. Whether the self-regulated learning pedagogy model nuances of the present study are of considerable importance to make significant differences to the way teachers approach PE teaching is debatable. If there is a valued uniqueness to self-regulated learning pedagogy it may be on the continued emphasis away from behaviorist teacher-centred frameworks to constructivist learner-centred frameworks. However, the Zimmerman model used in the present study probably requires a shift in praxis from a linear learning theory perspective to a 'non-linear' SRL pedagogy that reflects aspects of complexity theory (Ovens et al., 2013). However, there are challenges regarding the structuring of self-regulated learning practice within complexity theory. For example, such approaches will require considerable pedagogical skill and this is perhaps worthy of consideration regarding the initial teacher training PE programme in Taiwan, as well as in-service pedagogical development for PE teachers working in Taiwan.

Based on the findings of the present paper it would be problematic to make definitive statements about the efficacy of Zimmerman's suggested 4 level pedagogical approach to SRL in PE. Nuthall (2004) argued that reducing the teaching-learning process to generalizations leaves little to no relevance to the professional knowledge of the practitioner, partly because students can learn irrespective of what pedagogy is adopted. This suggests that the pedagogical emphasis first needs to help the learner see the value and significance of what is being offered to them to learn, and equally practitioners must value and believe in the theoretical framework of the pedagogy as a pivotal component of their underpinning philosophy of teaching. One must not assume that since PE activities are overt then their outcomes are always readily or immediately measurable. This would be a misleading argument for the empirical-scientific testing of learning that simply does not capture the complex nature of effective teaching. Therefore, some educational questions, such as what pedagogy to enhance SRL in PE, are perhaps more of a matter for philosophical argument.

Recommendations for future study.

1) Consider developing and testing alternative pedagogy approaches to promote autonomy supportive PE teacher behaviours. A starting point might be based on a hybrid of Zimmermann's model (used in the present study) and CREATE (Egan, 2011). The latter has been described as a model structured to scaffold the motivational aspects of SRL. Egan (2011) outlined CREATE as a six-step recursive (i.e. non-linear) process.
2) Investigate the association between teachers' leadership behaviours and the enhancement of SRL pedagogy in PE on both within beyond the classroom physical activity behaviour. There is potentially an interesting study re linking transformational sport teaching/coaching behaviours with the enhancement of self-regulation and intentions to be physically active beyond the PE lesson. Bourne et al. (2015) has found that when PE teachers make use of transformational teaching behaviours with adolescents this was positively related to both within class physical activity and leisure-time physical activity.

3) Based on the findings of Goudas et al. (2015), examine students' SRL and metacognitive feelings and metacognitive estimates (effort) during PE lessons over longer time periods. This could be relative to each of the stages of the 4 level model used in the present study, and in different age groups, possibly targeting children at higher risk of sedentariness.

Limitations.

- A limitation of the present study was the reliance on self-reported data which are susceptible to common method bias and inflated ratings (Siemsen et al., 2010) and more objective measures of SRL are needed. Common method bias was minimized by:
  1) emphasizing confidentiality, thereby reducing the likelihood that respondents edit their responses to be more socially desirable, lenient, acquiescent, and consistent with how they think the researcher wants them to respond (Podsakoff et al., 2003);
  2) having a time lag between the measurements that exceeded one month (Podsakoff and Organ, 1986).
- Another limitation was that this curriculum intervention was only 8 weeks and only immediate effects were assessed. Further study is warranted on longer intervention periods as well as the retention of effects.
- Due to constraints beyond the control of the investigators, the effectiveness of the control comparisons used in the study must be questioned. Only a single control group was available, which resulted in a large disparity between the sizes of the intervention and control groups. Furthermore, there were statistically significant differences at baseline for six of the eleven variables, where the control group reported higher mean values. The mean values of all control group variables at the post intervention testing which might have been expected to remain stable moved significantly in a 'negative' or undesirable direction. Without an explanation for these results a replication is necessary before more confident conclusions based on the control group comparisons can be drawn.

Conclusion

This 8-week intervention study involving 653 adolescent school students in Taiwan found significant statistical differences across time for nine out of eleven factors and interaction effects for treatment and groups for all eleven factors. For enjoyment, perceived competence, intrinsic value, self-efficacy, cognitive strategy use, goal setting, strategy implementation and strategy monitoring this appeared to be as a 'protection' against the negative effects seen in the control group. The results indicated that the intervention was successful in eliciting small increases in SRL behaviors, but more strikingly, stabilizing these behaviors as compared to a 'standard' PE experience. For the other three factors, effort, lack of self-regulation and test anxiety, while not providing any improvements in these learning strategies the intervention appeared to play a similar mediating role, so while there was not a reversal of the impact over time, the negative effects of the normal PE lesson appeared to be mediated.

Thus, future research, as noted in the recommendations is needed. This study provides a starting point only from which to build future SRL pedagogical

interventions in PE in Taiwan, with the goal of improving long-term volitional participation in sport, exercise and health related activity.

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