Physical Education in Taiwan, when students take control: Investigating the impact of self-regulated learning pedagogy in Physical Education.

*Keywords*: Taiwan; Self-regulated Learning; Physical Education; Pedagogy.

Articles and papers were sourced by a keyword search in *Google Scholar* and *Entrez pubmed* utilizing motivation, self-determination, self-regulation, transformational teaching, Physical Education.
Abstract
Self-regulation is seen as an inclusive approach to student learning, and physical educators have a responsibility to create a learning environment that is supportive of self-regulated learning. 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. Constructs from the Intrinsic Motivation Inventory (IMI), the Motivated Strategies for Learning Questionnaire (MSLQ), and the Five Component Scale for Self-Regulation (FCSSR) were used on an online survey platform (Bristol Online Surveys) pre and post an 8-week PE curriculum intervention (weekly PE lessons) in Taiwan. Participants were 632 Taiwanese Junior High School students (aged 12-15 years; 28 PE classes) and a waiting list control class (n = 21; aged 14-15 years). Multiple repeated measures ANOVAs were used to determine if there were significant differences pre to post intervention period and also interaction effects between the intervention and the control class. Over time the intervention classes 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, eight out of the eleven factors for the control class showed relatively larger negative changes in scores. This data indicates that the benefits of adopting a self-regulated learning approach in PE lessons in Taiwan over an 8-week period appear to be more about the stability of these personal characteristics rather than the enhancement of them.
Introduction

In occidental societies school disengagement and dropout are major concerns along with growing sedentariness among youth (Janssen, 2012; Moffit et al, 2011). Chinese based society has traditionally been known for adopting psychologically controlling styles of interaction with children and youth (Ng, Pomerantz & Deng, 2014). Research has shown that Asian learners who perceive a lack of autonomy-supportive educational contexts display poorer time management and more distraction (Vansteenkiste, Zhou, Lens & Sorens, 2005) and the more children experience psychologically controlling environments the more they are likely to suffer emotionally and academically (Wang, Pomerantz & Chen, 2007). Chinese society has been described as ‘masculine’ (such as 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 is 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), relates to less self-determined motivation (Parish & Treasure, 2003), poorer performance, and effort withdrawal (Nerstad, Roberts & Richardsen, 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 the relative success or failure will be accentuated 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 & 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 & 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 that intrinsic motivation 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 student’s perceptions of adequate competence more resilient in PE (Standage, Duda & Ntoumanis, 2005), thereby supporting a positive relationship between mastery climate and self-determined motivation (Moreno, Gonzalez-Cutre, Sicilia, Spray, 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 i.e. the need for being the perceived origin of one’s own behaviors (Deci & 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), and 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 & Schunk, 2011, p.1). Probably the most-quoted definition of SRL stems from Schunk and Zimmerman (1994): SRL means 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 & 2008), and this assumes learners employ agency through active
control and monitoring of their learning (Winne & Hadwin, 2008). 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, Ryan, Deci, & Jang, 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, Hutchinson and Thauberger, 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 of self-regulation development and, based on this model Goudas, Kolovelenis, 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 practice the skill in changing conditions to develop their competence to perform the skill in changing environments or to practice the skill to further develop automaticity in the case of skills performed in closed environments. 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 practice 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 and involved a “control” group and a group of students from 28 PE classes in Taiwan. Twenty-eight (17 male; 11 female; mean age 22 years) year 3 undergraduate (Hons) Asian PE students from the National Taiwan Normal University (NTNU) were recruited as student teachers for the project. Three Junior High Schools (JHS) in Taiwan, associated with practicum experiences of NTNU PE students, agreed to facilitate this research within their weekly PE lessons, involving 28 PE classes and 632 students (aged 12-15 years). There was a fourth JHS which provided an 8-week waiting list control class (n = 21; aged 14-15 years) i.e. they would receive access to the curriculum intervention after 8 weeks. All participants provided informed consent and this study was approved by the Moray House School of Education (University of Edinburgh, Scotland) Research Ethics Committee.

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 and not be 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 pedagogical 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 PE colleagues at NTNU and the partner schools throughout the 8-weeks. Applying Zimmerman’s (2000) 4 level model for SRL, this involved proceeding sequentially in lesson planning, such as:

1. observational learning (e.g. verbal instructions/visual demonstrations);
2. emulation (e.g. practice 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 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. practice skills in changing environments to develop competence re open skills or practice 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 $\rightarrow$ emulation $\rightarrow$ self-control $\rightarrow$ self regulation was central to this pedagogical approach in PE to promote self-regulated learning and positively impact on the motivational climate of a PE lesson. On a weekly basis the lead researcher, with 40 years of PE pedagogy experience (practical and research) conducted SRL activity workshops with and taught each planned SRL PE lesson to the PE students at NTNU prior to the students delivering the lesson to the JHS students in their schools. The teachers of the control group received in-service workshops to enable them to deliver the same curriculum intervention post the 8-week intervention period.

**Online survey**

Constructs from the Intrinsic Motivation Inventory (IMI), the Motivated Strategies for Learning Questionnaire (MSLQ), and the Five Component Scale for Self-Regulation (FCSSR) were used as a framework to guide the design before loading to an online survey platform (Bristol Online Surveys) in the Mandarin Chinese language. An iterative translation process (English to Mandarin Chinese language) of revision 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 university PE lecturer from the National Taiwan Normal University (NTNU; Taipei), and two Mandarin Chinese language postgraduate students (from Taichung and Taipei) across a three month period (January-March 2015). Prior to main-stage fieldwork, 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.

**Pre and post pedagogy intervention measures**

Three self-report measures in the field of SRL and motivation were chosen for this study. The Intrinsic Motivation Inventory (IMI) is a multidimensional measurement device intended to assess participants’ subjective experience related to an activity, and has been used in several experiments related to intrinsic motivation and self-regulation (e.g. Deci, Eghrari, Patrick, & Leone, 1994). The instrument assesses participant enjoyment, perceived competence, and effort.

The 44-item Motivated Strategies for Learning Questionnaire (MSLQ) is a self-report instrument (intrinsic value, self-efficacy, anxiety, learning strategies, lack of self-regulation) designed to measure students' motivational orientations and their use of different learning strategies (Pintrich, Smith, Garcia, & McKeachie, 1991). The MSLQ has been used extensively in Western settings (e.g. Cheang, 2009) but is 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, Chan and Sachs, 2008). Liu et al (2012) and Ng, Wang and Liu (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, based on a 7-point Likert scale, in the Asian cultural context.

In addition to using the 28-item MSLQ, MacLellan and Soden’s (2006) measurement tool (a modified version of the Martinez-Pons’ [2000] Five Component Scale for Self-Regulation [FCSSR]) was also included in this study because it focuses on the environmental context students are learning in. Based on a social cognitive model, this modified version of the FCSSR includes goal setting, using strategies, and strategy monitoring subscales.

**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 pre to post
intervention period and also interaction effects between the intervention and the control group. These statistical analyses allowed us to examine the changes across time for enjoyment, effort, perceived competence, intrinsic value, self-efficacy, cognitive strategy use, lack of self-regulation, test anxiety, goal setting, strategy implementation and strategy monitoring, and whether group mediated this effect.

Results

Motivation
The results for the impact of the intervention on the motivational factors, enjoyment, perceived competence and effort, revealed some significant differences across time, and also significant interaction effects. Specifically, there were significant differences across time for enjoyment (F(642,1) = 7.920; P<0.05; ηp² = .012; and effort (F(642,1) = 18.547; P<0.05; ηp² = .028); but not perceived competence (F(643,1) = 3.745; P>0.05; ηp² = .006). Furthermore, significant interaction effects were revealed for all three factors, enjoyment (F(642,1) = 9.346; P<0.05; ηp² = .014; effort (F(642,1) = 16.703; P<0.05; ηp² = .025); and perceived competence (F(643,1) = 4.275; P<0.05; ηp² = .007). Descriptively, 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 (see figure 1).

Figure 1. Mean pre and post scores for enjoyment, perceived competence, and effort using the Intrinsic Motivation Inventory, for 632 school students who participated in the 8-week self-regulated learning approach in PE lessons in Taiwan.
In comparison, the control group showed relatively larger reductions in scores for enjoyment, perceived competence and effort, revealing the likely source of the significant interaction effects between the groups (see figure 2).

**Figure 2.** Mean pre and post scores for enjoyment, perceived competence, and effort using the Intrinsic Motivation Inventory, for 21 school students who participated in 8-week block of standard PE lessons in Taiwan.

**Strategies for Learning**

With regards to the Motivated Strategies for Learning Questionnaire, there were significant differences across time from pre to post and also significant interaction effects between the groups for all five factors. Specifically, across time, intrinsic value ($F(637,1) = 6.133; P<0.05; \eta^2 = .01$); self-efficacy ($F(636,1) = 4.387; P<0.05; \eta^2 = .007$); cognitive strategy use ($F(638,1) = 7.146; P<0.05; \eta^2 = .011$); lack of self-regulation ($F(636,1) = 13.385; P<0.05; \eta^2 = .021$); and test anxiety ($F(636,1) = 11.464; P<0.05; \eta^2 = .018$). Furthermore, the interaction effects were as follows: intrinsic value ($F(637,1) = 9.980; P<0.05; \eta^2 = .015$); self-efficacy ($F(636,1) = 6.397; P<0.05; \eta^2 = .01$); cognitive strategy use ($F(638,1) = 8.872; P<0.05; \eta^2 = .014$); lack of self-regulation ($F(636,1) = 11.150; P<0.05; \eta^2 = .017$); and test anxiety ($F(636,1) = 8.385; P<0.05; \eta^2 = .013$).

Descriptively, scores for the intervention group in intrinsic value, self-efficacy, cognitive strategy use, lack of self-regulation and test anxiety all increased across time, as seen in figure 3.
Figure 3. Mean pre and post scores for intrinsic value, self-efficacy, cognitive strategy use, lack of self-regulation, and test anxiety using the Motivated Strategies for Learning Questionnaire, for 632 school students who participated in the 8-week self-regulated learning approach in PE lessons in Taiwan.

Descriptively, the scores for the control group dropped for intrinsic value, self-efficacy and cognitive strategy use, and increased to a larger degree than the intervention group for lack of self-regulation and test anxiety – see figure 4. The interaction effects that is revealed between the groups for each of the factors is clear by comparing figures 3 and 4. Specifically, the intervention group appeared to reverse the negative effect seen for intrinsic value, self-efficacy and cognitive strategy use and decrease the negative effect of lack of self-regulation and test anxiety that occurred across time in the control group.
Figure 4. Mean pre and post scores for intrinsic value, self-efficacy, cognitive strategy use, lack of self-regulation, and test anxiety using the Motivated Strategies for Learning Questionnaire, for 21 school students who participated in 8-week block of standard PE lessons in Taiwan.

Strategies for Self-Regulation
With regards to 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; ηp² = .008); strategy implementation (F(623,1) = 7.165; P<0.05; ηp² = .011); but not strategy monitoring (F(619,1) = 3.482; P>0.05; ηp² = .006). However, there were significant interaction effects between the groups for each factor, goal setting (F(637,1) = 6.434; P<0.05; ηp² = .01); strategy implementation (F(623,1) = 8.224; P<0.05; ηp² = .013); and strategy monitoring (F(619,1) = 6.050; P<0.05; ηp² = .01). Descriptively, for the intervention group the scores for goal setting, strategy implementation and strategy monitoring all increased from pre to post across time, see figure 5.
Figure 5. Mean pre and post scores for goal setting, strategy implementation and strategy monitoring using the Five Component Scale for Self-regulation, for 632 school students who participated in the 8-week self-regulated learning approach in PE lessons in Taiwan.

However, for the control group the scores for goal setting, strategy implementation and strategy monitoring all decreased from pre to post across time, see figure 6. This highlights a clear reason for the interaction effects that were observed.

Figure 6. Mean pre and post scores for goal setting, strategy implementation and strategy monitoring using the Five Component Scale for Self-regulation, for 21 school students who participated in 8-week block of standard PE lessons in Taiwan.
Discussion

The study revealed significant changes in almost all of the factors across time for the pupils involved in this work (both control and intervention group), with the exception of perceived competence and strategy monitoring. Of more interest in real terms are the significant interaction effects that were revealed between the intervention and control groups for all eleven factors associated with motivation, and strategies for learning and self-regulation.

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). Furthermore, the intervention group showed small negative changes in 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 (-0.18), 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). Furthermore, for three of the factors, while the intervention group did not show a reversal of the response over time as it did for the other eight factors, it appeared to mediate the decline. For example, for the control group changes across time for effort (-1.12), lack of self-regulation (+1.05) and test anxiety (+0.92), were much greater than the intervention group. Therefore, this data is indicating the benefits of adopting a self-regulated learning approach in PE lessons for school students aged 12 – 15 years in Taiwan over this 8-week period appear to be more about the stability of these personal characteristics rather than the enhancement of 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 we found a slight non-significant reduction in effort within the IMI for the intervention group, but one can interpret this as effort being maintained pre to post intervention – because it falls within the expected day-to-day
variation in responses about effort. However, a significant reduction in effort was seen for the control group. 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, Dermizaki and Kolovelonis (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 reported a main effect for time (pre estimate to post experience of the basketball practice) regarding feelings of effort i.e. students reported higher feelings of effort having had the actual experience of the practice of the basketball skill exerting effort. 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 promising findings of the present study 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, Hopper and Butler, 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 PE programme at NTNU, 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.

Recommendation for future study

1) Consider developing and testing alternative pedagogy approaches to promote autonomy supportive PE teacher behaviors, possibly based on based on a hybrid of Zimmermann’s model (used in the present study) and CREATE (Egan, 2011), which could be described as a model structured to scaffold the motivational aspects of SRL. Egan (2011) outlined CREATE as a six-step recursive (i.e. a non-linear process).

2) As well as developing & testing a ‘non-linear’ pedagogy model of SRL in PE consider including student perceptions of transformational teaching (Beauchamp, Barling, Li, Morton, Keith, Zumbo, 2010; Morton, Keith &
Beauchamp, 2010; Slavich & Zimbardo, 2012) into the study design.

3) Future study could also 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 coaching behaviours with enhancement of self-regulation and intentions to be physically active beyond the PE lesson. For instance, recently Bourne et al (2015) 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.

4) Based on the findings of Goudas et al (2015) it would be worthwhile to examine students’ SRL and metacognitive feelings and metacognitive estimates (effort) during PE lessons over longer time periods 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.

5) Following on from the conclusions drawn from the Piche et al (2015) study, future research needs to investigate further the associations between SRL in PE and participation in structured extra-curricular sport, exercise and health related activities in different age groups, to help children and youth develop positive healthy dispositions in emerging adolescence.

6) Finally, this curriculum intervention was only 8 weeks and only immediate effects were assessed. Further study is warranted on the retention of effects as well as longer intervention periods.

**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, Roth & Oliveira, 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 & Organ, 1986).
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 between the intervention and control group 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 reversing the negative effect seen in the control group. 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, the intervention appeared to play a mediating role, so while there was not a reversal of the impact over time, the negative effects appeared to be mediated.

Thus, future research, involving a longer intervention period and across a range of age groups, with follow-up support for PE teachers and students of PE is recommended. This study provides a foundation 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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