Self-regulated learning in physical education: An analysis of perceived teacher learning support and perceived motivational climate as context dependent predictors in upper secondary school

Aron Laxdal (corresponding author)
aron.laxdal@uis.no

Atle Mjåtveit
atle.mjaatveit@uis.no

Eva Leibinger
eva.leibinger@uis.no

Tommy Haugen
tommy.haugen@uia.no

Rune Giske
rune.giske@uis.no

The aim of this cross-sectional study was to investigate the relationship between teacher learning support, motivational climate and self-regulated learning in upper-secondary school physical education. A sample consisting of 554 upper secondary school students from Norway (M_{age} = 17.05, *SD* = 0.91) answered a survey pertaining to their everyday experiences in physical education. A multiple regression based structural equation model indicated that teacher learning support, ego-involving motivational climate and task-involving motivational climate were all significant positive predictors of self-regulated learning, with teacher learning support emerging as the most prominent predictor. These results add to the cumulative knowledge that exists on the relationship between teacher dependent environmental factors and individual behavior within the physical education context.

Keywords: assessment for learning, formative assessment, learning environment, self-regulation

The physical education (PE) community is characterized by the clash of two leading agendas; the public health agenda and the educational agenda (O'Sullivan, 2004). Those adhering to the educational agenda believe that learning and individual development are paramount in the PE context. Conversely, those adhering to the public health agenda believe the subject to be a platform to fight hypokinetic disease and disrupt the sedentary quotidian that permeates our society. As the public health agenda gains impetus, fitness and recreation become more prominent in the curriculum, at the expense of learning (Crum, 2012). The educational agenda, on the other hand, emphasizes the enhancement of knowledge and competence using carefully constructed teaching strategies. Adhering to the educational agenda requires qualified teachers, who possess the pedagogical and didactical capabilities to effectively navigate the complex landscape of PE (O'Sullivan, Tannehill & Hinchion, 2010). Because of PE's distinctiveness, as a subject that engages both the mind and the body, and due to the subject's inherently enjoyable nature, there is an added need to explicitly communicate learning goals, and how they can be achieved, to the students. Without a clear directive from the teacher, the students may be

inclined to view the subject as being recreational, which might reduce their incentives to engage in learning enhancing behavior (Cothran, 2010).

In an effort to advance the debate on these polarizing agendas, the current study attempted to shed some light on the prevalence of such behavior and the environment in which it may be facilitated. One such behavior that has been found to differentiate between effective and less effective learners, in PE and elsewhere, is the self-regulation of learning (Cleary, Platten & Nelson, 2008; Kolovelonis, Goudas & Dermitzaki, 2011a, 2012; Kolovelonis, Goudas, Hassandra & Dermitzaki, 2012; Zimmerman, 2006). Self-regulated learning is a process that involves proactively directing behavior and using strategies to achieve self-set goals (Cleary & Zimmerman, 2004). The aforementioned behavior, which is recognized by Hattie (2012) as being a key factor in understanding the process of learning, is not viewed as an innate trait, which an individual either possesses or not, but rather as a malleable context-specific environmental response (Zimmerman, 2002). Students who self-regulate their learning have been found to be more likely to monitor their progress, focus on self-improvement, take advantage of learning opportunities and to seek help, than their peers (MacNamara, Button & Collins, 2010; Zimmerman, 2008). Measuring an individual's propensity for regulating his or her own learning can be achieved in various ways, including but not limited to, thinking aloud protocols, classroom observations, self-reporting, event measures and learning diaries (Dugan & Andrade, 2011; Greene, Robertson & Costa, 2011; Panadero, Klug & Järvela, 2016; Perry & Rahim, 2011; Winne & Perry, 2000).

According to Zimmerman (1998; 2000), self-regulated learning is a cyclical process where reflections on earlier experiences are used to improve upon impending learning efforts. The process can be divided into three phases: The forethought phase, which occurs before the learning effort and involves goal setting, strategic planning and the acquisition of task related knowledge. The performance phase, which occurs during the learning effort, involves the

implementation of the strategies proposed in the previous phase and the self-observation required to track personal functioning. The final phase is the self-reflection phase, which occurs after the learning effort and involves performance evaluation, causal attribution and adaptive reactions to learning strategies (Zimmerman, 2002). Depending on the behavioral feedback observed during the learning effort and whether the initial goals were achieved, adjustments may be made to the learning strategies used (Zimmerman, 1989). More specifically, self-regulated learning involves knowing how to set goals, realizing what is needed to achieve those goals and determining how to actually achieve those goals (Dabbagh & Kitsantas, 2012).

Most of the research on self-regulated learning in PE to date centers on the mastery of specific skills (e.g. Kolovelonis et al., 2011a, 2011b, 2012a, 2012b), and to a lesser degree on the general prevalence of the behavior, and the way it interacts with various other elements of the PE lessons. Kolovelonis et al., (2011a, 2011b, 2012a) stress the teachers' role in facilitating the use of self-regulatory behavior such as task analysis, self-talk, self-recording and goal setting in PE, as this behavior does not appear to occur naturally in the context. If the teachers were to capitalize on the students' comparatively high motivation to participate in PE tasks and activities, especially during the formative years, the behavior would likely be more prevalent and occur more naturally.

The Norwegian context makes for an interesting setting due to the 2006 school reform, which built on Black and Wiliam's (1998) work on formative assessment. In line with the principles of formative assessment the teachers have been encouraged to share learning goals, reward effort and make continuous assessments that facilitate learning (Forskrift til opplæringsloven, 2006; Tveit, 2014). The reform has been particularly important in the PE context, where the previously prevailing assessment practices were controversial and devoid of formative purpose (Arnesen, Nilsen & Leirhaug, 2013; Leirhaug, 2016). The reformed assessment guidelines are more interactive and involve the students in their own evaluation to

a larger extent than before (Tveit, 2014). They involve the teachers making inferences about the students' current abilities and subsequently applying formative procedures to facilitate progress. By adopting formative assessment practices, the teachers are able to promote proactive rather than reactive learning behavior (Nicol & Macfarlane-Dick, 2006).

As indicated by the model for learning enhancing feedback there are conceptual communalities between formative assessment and self-regulated learning (Hattie & Timperley, 2007). All formative behavior, whether internally or externally facilitated, aims to reduce the discrepancy between current and desired understanding by answering the three questions of: 1) what are the goals? 2) what progress is being made toward the goals? and 3) what activities need to be undertaken to make better progress? (Hattie & Timperley, 2007). In a way, these processes can be viewed as two sides of the same coin, internal and external facilitators of the same behavior, aspiring to the same outcome; allowing students to take greater ownership over their own development, and adapting their learning goals and strategies to fit current abilities. Henceforth, formative teaching behavior will be referred to as teacher learning support.

Previous research in PE, and elsewhere, has found that different teacher dependent environmental aspects, including the motivational climate, influence the degree to which individuals self-regulate their learning (McCaslin et al., 2006; Peeters et al., 2014; Ommundsen, 2006; Theodosiou & Papaioannou 2006; Young, 2005; Zimmerman, 2002). The motivational climate refers to the collective perception of the situational achievement goal structure, and is generally considered as being predominantly task- or ego-involving (Ames, 1992; Duda, 2001). A task-involving climate describes an environment where every student is valued, success is regarded as attainable, effort is rewarded, and learning is important. The various activities and tasks presented are designed to be optimally challenging and mistakes are regarded as an integral part of the learning process (Ames, 1992; Papaioannou, 1995). Contrastingly, an ego-involving climate describes an environment of social comparison and competence-based

favoritism, where the outcome is valued above effort and mistakes are punished. Goal orientations are not bipolar, meaning that they do not exist at opposite extremes of a spectrum, but rather orthogonal, meaning that both can coexist to a different degree at the same time. In other words, students can perceive an environment as being both ego-involving and task-involving at the same time, and any individual can score high or low on both ego-orientation and task-orientation (Duda, 2001; Ferrer-Caja & Weiss, 2000; Young, 2005). The degree to which task- or ego-involvement is predominant within a given environment, has been found to have positive or negative influence, respectively, on numerous aspects within the PE context; including motivation, satisfaction, competence, motor-skills and fitness (Braithwaite, Spray, & Warburton, 2011).

Research into the relationship between the motivational climate and self-regulated learning is limited, in both the PE context and elsewhere. However, there are indications of a distal relationship between the constructs. Ommundsen (2006) and Theodosiou and Papaioannou (2006) reported a positive relationship between a task-involving climate and self-regulation, while reporting inconsistent relations with an ego-involving climate. The inconsistency appears to be caused by the more proximal self-enhancing and self-defeating ego-orientations, and the diverging influences they have on self-regulation (Ommundsen, 2006).

The objective of this study was to gain a better understanding of the potential role teacher dependent environmental factors play in shaping the learning behavior of the individuals within the Norwegian upper secondary school physical education context. The specific research question that guided this research was ‘How do the perceived teacher learning support and the perceived motivational climate effect the student’s self-regulation of their own learning?’ A hypothesized model illustrating the expected nature of the relationships between the measured variables can be seen in figure 1. The inconsistent findings of previous research concerning the relationship between an ego-involving climate and self-regulated learning

hindered our ability to make a meaningful prediction on that particular relationship in the current study.

Method

Sample and procedure

554 upper secondary school students (M_{age} = 17.05, SD = 0.91) from four schools in the Rogaland district of Norway participated in this study. The participants were recruited from schools representing both urban, suburban and rural settlements, using a stratified sampling procedure. Informed consent was obtained from all participants and school representatives before any data was collected. A project leader administered the questionnaire during PE class. The data collection took place in the fall of 2017 and was approved by the Norwegian Social Sciences Data Service (NSD).

Measures

The degree to which the students self-regulated their learning was measured using a PE-specific version of the Self-Regulation subscale of the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich & De Groot, 1990). This subscale from the original version of the MSLQ was partially based on Zimmerman and Pons' (1986, 1988) theories on metacognitive strategies. The subscale composed of nine items and was measured on a 7-point Likert scale ranging from 'Not at all true of me' (1) to 'Very true of me' (7). Examples of items include 'Before the activities start, I think about the things I will need to do to learn' and 'When the lesson is over, I reflect on what I have learned.' The scale was found to demonstrate satisfactory construct validity and internal consistency in the academic context (Pintrich & De Groot, 1990).

Using Hopfenbeck's (2014) Regulation for Meaningful Assessment, Hattie and Timperley's (2007) model for learning enhancing feedback, and the principles of formative assessment as reference, a nine item single factor PE-specific scale measuring perceived teacher learning support was constructed for the purpose of this study. The items measured the students'

experiences with key elements of teacher learning support, such as the dissemination of learning goals, use of feedback and willingness to modify behavior. Items include questions such as "It is important to the PE teacher that we learn new skills' and 'The PE teacher provides us with clear advice on how we can improve our performance' (the full list of items can be seen at the bottom of this article). Responses were given on a 6-point Likert scale ranging from 'never' (1) to 'always' (6). This measure was constructed as a means of measuring the prevalence of the integrated teaching processes that aim to improve learning, increase student involvement in the learning process, assess current performances and communicate appropriate action for progression (López-Pastor, Kirk, Lorente-Catalán, MacPhail & Macdonald, 2013; Sadler, 2010).

The students' perception of the motivational climate was measured using a PE-specific version of the Perceived Motivational Climate in Sport Questionnaire (PMCSQ; Seifriz, Duda and Chi, 1992), which consists of two subscales measuring task-involving climates (9 items), and ego-involving climates (11 items). Each item was measured on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Items measuring task-involvement focused on effort and teamwork, while ego-involving items focused on individuality and competition. Examples of items are 'In this PE class, trying hard is rewarded' and 'In this PE class, doing better than others is important.' The instrument has previously been found to demonstrate satisfactory construct validity and internal consistency in the Norwegian context (Ommundsen, Roberts, Lemyre & Treasure, 2003).

Statistical Analysis

Using M*plus* 8 statistical software, a structural model consisting of three exogenous (teacher learning support, ego-orientation and task-orientation) and one endogenous variable (self-regulated learning) was examined in this study. All variables were measured as latent constructs. To account for missing values and potential non-normality of data, a maximum

likelihood estimation method with robust standard errors was utilized. Prior to placing each latent construct into the structural model, the factor structure of each construct was analyzed through a measurement model. The fit of each model was assessed using the Satorra-Bentler chi-square (S-B χ^2; Satorra & Bentler, 1994), which has been found to be sensitive to sample size, and should therefore be assessed in conjunction with the Tucker-Lewis index (TLI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR; Byrne, 2012). The benchmarks for acceptable fit using the aforementioned measures are as follows: CFI and TLI should be close to or above .95, while RMSEA and SRMR should be $\leq .06$ and $\leq .08$ respectively (Hu & Bentler, 1999). For the purpose of scaling the latent variables to a common metric, one indicator per latent variable was fixed to 1.0. As recommended by Byrne (2012), any re-specifications of measurement models were reported. The internal consistency of the latent constructs was assessed using Raykov's rho (ranges from 0-1; Raykov, 1998), which is now preferred to the more traditional Cronbach's alpha (Cronbach, 1951) as it is believed to yield more accurate estimates (Yang & Green, 2010). Contrary to Cronbach's alpha, Raykov's rho does not require equal contribution of items to factorial variance, and accounts for correlated error variance (Raykov, 1998).

Results

Preliminary analysis

A confirmatory factor analysis (CFA; Jöreskog, 1969) was performed on pilot data from 389 students from various school levels in Norway (elementary school (n = 169), lower secondary school (n = 113) and upper secondary school (n = 107)) to confirm the hypothesized single-factor structure and analyze the internal validity of the teacher learning support in PE scale. The initial measurement model indicated less than acceptable fit (S-B χ^2 = [df =27, N = 388] = 94.77, $p < .001$; TLI = .90; CFI = .93; RMSEA = .08 [.06 - .10]; and SRMR = .04). Inspection

of factor loadings indicated that one item ('The PE teacher concludes the lesson with a short recap of what we learned during that lesson') contributed modestly to the latent construct (< .50). That item was subsequently removed from the scale. The measurement model for the revised eight-item scale indicated improved model fit (S-B χ 2 = [df = 20, N = 388] = 78.97, p < .001; TLI = .91; CFI = .93; RMSEA =.09 [.07 - .11]; and SRMR = .04); however, not to the degree that the model would be deemed acceptable. Upon inspection of modification indices, high covariance was discovered between two pairs of items ('The PE teacher informs us as to what we are supposed to learn' had high covariance with 'The PE teacher provides us with clear aims for the lesson, and tells us what is expected of us,' and 'The PE teacher gives feedback that is indicative of the quality of our work' had high covariance with 'The PE teacher provides us with clear advice on how we can improve our performance'). An item examination revealed that although they intended to measure different elements of the latent construct, the wording of the items could make them difficult to discern from one another, especially for the younger participants. Allowing these two pairs of items to co-vary in line with Byrne's (2012) recommendations resulted in excellent fit indices for the re-estimated model (S-B χ 2 = [df = 18, N = 388] = 19.96, p = .335; TLI = 1.0; CFI = 1.0; RMSEA =.02 [.00 - .05]; and SRMR = .02).

Descriptive Statistics

Descriptive statistics, internal reliability scores and the correlation matrix for all latent variables can be seen in table 1. All measurements displayed satisfactory levels of internal consistency (>.70; DeVellis, 1991), with Raykov's rho ranging from .82-.91.

Confirmatory factor analysis

To confirm the hypothesized factor structure of the latent variables, both the exogenous and the endogenous variables were analyzed using a CFA. Initial results on every measured variable indicated non-acceptable fit; however, close inspection of both the measurement models and

the content of the items gave cause to re-specify the models in line with Byrne's (2012) recommendations. The re-estimated models were all found to have adequate fit.

The initial measurement model of the nine-item self-regulation subscale of the MSLQ yielded non-acceptable fit (S-B χ 2 = [df = 27, N = 554] = 332.52, $p < .001$; TLI = 0.56; CFI =0.67; RMSEA = 0.14 [0.13 – 0.16]; and SRMR = 0.12). Inspection of the factor loadings revealed that four (three of which were reversed) out of the nine items contributed modestly or not at all ($p > .05$) to the latent construct, indicated by low factor loadings (< .20) and high residuals (> .90). The less than adequate fit may have been influenced by the negative wording of the items, which can cause an agreeing-response effect or acquiescence (i.e., the tendency to answer items in a positive way regardless of their content; Bentler, Jackson & Messick, 1971; Billiet, & Davidov, 2008). In line with Byrne's (2012) recommendations these items were omitted, which resulted in acceptable model fit for the remaining five items (S-B χ 2 = [df = 2, N = 554] = 14.55, $p = .012$; TLI = .96; CFI = .98; RMSEA = .06 [.03 - .10]; and SRMR = .02). The omitted items all pertained in some way to focus and perseverance. As the remaining items still include the three basic elements from Zimmerman's framework for self-regulated learning (forethought, performance and self-reflection), which was foundational to the original measure (Pintrich & De Groot, 1990), the abbreviated scale was deemed acceptable.

The initial measurement model for the eight-item teacher learning support in PE scale indicated non-acceptable fit (S-B χ^2 = [df = 20, N = 549] = 123.48, $p < .001$; TLI = .92; CFI = .95; RMSEA = .10[.08 - .11]; and SRMR = .04). Repeating the same modifications to the measurement model that yielded excellent fit in the pilot study yielded acceptable fit (S-B χ 2 = [df =18, N = 549] = 53.96, $p < .001$; TLI = .97; CFI = .98; RMSEA = .06[.04 -.08]; and SRMR = .03; Hu & Bentler, 1999).

The initial measurement model for the two factor PMCSQ yielded non-acceptable fit (S-B χ 2 = [df = 169, N = 542] = 836.98, $p < .001$; TLI = .77; CFI = .80; RMSEA = .09 [.08 -

.09]; and SRMR = .08). An inspection of factor loadings revealed that four items from each subscale contributed modestly to the latent construct, indicated by low factor loadings (< .50). Omitting these items from the model resulted in a better, but still non-satisfactory fit (S-B χ 2 = [df = 53, N = 542] = 454.66, $p < .001$; TLI = .79; CFI = .83; RMSEA = .12[.11 - .13]; and SRMR = .07). An inspection of modification indices revealed high covariance between two items on the ego-subscale ('in this class, outperforming classmates is important' had high covariance with 'in this class, doing better than others is important') and two items on the task-subscale ('in this class, the teacher focuses on skill improvement' had high covariance with 'in this class, each student's improvement is important'). A content examination of the items revealed similarities in phrasing and meaning which could explain the high covariance. Allowing these items to co-vary resulted in acceptable fit for the re-estimated model (S-B χ 2 = [df = 51, N = 542] = 124.09, $p < .001$; TLI = .96; CFI = .97; RMSEA = .05[.04 - .06]; and SRMR = .04). Despite the modifications made to the measure, the remaining items still envelop the key principles of task-involving climate, such as self-improvement, learning and affiliation.

Regression-based SEM-analysis

As can be seen in figure 2, the structural model includes three exogenous (teacher learning support, ego-orientation and task-orientation) and one endogenous variable (self-regulated learning). The model yielded acceptable fit-indices (S-B χ^2 = [df = 265, N = 550] = 541.04, $p < .001$; TLI = .95; CFI = .95; RMSEA = .04 [.04 - .05]; and SRMR = .05), according to the guidelines outlined by Hu & Bentler, (1999). The β coefficients, which indicate the strengths of the relationships between the latent variables, were all significant ($p < .01$). All three exogenous variables had a positive relationship with self-regulated learning, with teacher learning support emerging as the most prominent predictor. The complete model explained 28 % (R^2 = .28, SE = .05, $p < .001$) of the variation in self-regulated learning among students.

Discussion

The aim of this study was to investigate the relationship between teacher learning support, motivational climate and self-regulated learning in upper secondary school PE. In other words, to explore whether and to which degree teacher dependent environmental factors influenced the learning behavior of the students in the chosen context. In line with our expectations, the structural model indicated significant relationships between the environmental factors and self-regulated learning. Collectively, teacher learning support and the motivational climate accounted for 28 % of the variance in self-regulated learning. The mean score for self-regulated learning was relatively low (below the arithmetic mean of the scale) compared to the mean scores reported in previous studies in the academic context (Pintrich, Smith, Garcia & McKeachie, 1993; Saks, Leijen, Edovald, & Õun, 2015; above the arithmetic mean of the scale), indicating that self-regulatory behavior is not particularly prevalent in the Norwegian PE context. However, the score for teacher learning support (above the arithmetic mean of the scale) indicates that the students perceive that PE teachers do actively engage in learning enhancing behavior. The mean scores for ego- and task involving motivational climates mirrored results from previous research in the field, indicating that while both are prevalent, task-involving climates are more dominant (Ferrer-Caja & Weiss, 2000; Solmon, 1996).

In line with our expectations, the structural model indicated a significant inter-variable relationship between the exogenous variables (teacher learning support, ego-involving climate and task-involving climate). As expected, the nature of these relationships varied. Congruent with previous research, the relationship between ego-and task-involving climates was negative (Moreno-Murcia, Sicilia, Cervelló, Huéscar, & Dumitru, 2011). As hypothesized, the relationships between teacher learning support and ego-involving climate on one hand and teacher learning support and task-involving climate on the other, were respectively negative and positive. The strength of the relationship between teacher learning support and a task-

involving climate, illustrated by a *r*-coefficient of .60 and a β-coefficient of .72, was in accordance with our expectations. The two constructs share some underlying principles; such as the tolerance of failure, support for learning and a preoccupations with acquiring and improving both skill and knowledge. These findings give further support to the validity of the teacher learning support scale, and indicate theoretically meaningful relations between the constructs.

Congruent with our expectations, the relatively strong relationship between teacher learning support and self-regulated learning was positive. These findings give further support to the claims that teachers can play an integral role in determining the degree to which their students self-regulate their learning (Peeters et al., 2014; Tay, 2015). Even though certain individual characteristics, such as intellectual curiosity and social identity (Torrano Montalvo & González Torres, 2004; Wang & Holcombe, 2010), have been found to predict self-regulation, the students still depend on the teachers to disseminate learning goals, give feedback on progress and make adjustments to the learning goals and strategies, for the endeavor to be successful (Hattie & Timperley, 2007).

Because of the inconsistency of prior research on the relationship between ego-involvement and cognitive engagement (Ommundsen, 2006), expectations concerning that particular relationship were unclear. Irrespective of the lack of presupposition, the strength of the relationship between ego-involvement and self-regulated learning was somewhat unexpected. These results are at odds with normative goal theory, which supposes that social comparison and concern with besting others creates an environment that undermines self-regulated learning (Pintrich, 1999; Randi & Corno, 2000). However, our findings are in line with the results of a handful of studies, which claim that preoccupation with outperforming others can, in certain circumstances, have a positive impact on motivation, self-regulation and learning (Ommundsen, 2006; Pintrich, 1999; 2000).

According to Skaalvik and colleagues (Skaalvik, 1997; Skaalvik, Valåns & Sletta, 1994) the positive or negative effects an ego-involving climate has on an individual's behavior is heavily influenced by the complexion of the individual's ego-orientation, and whether the genesis of social comparison is self-enhancing or self-defeating. In other words, the response to an ego-involving climate, is largely determined by whether the individual's ego-orientation stems from the yearning to be the best and to display superior ability, or the desire to avoid looking stupid, being the worst performer in the class or avoiding negative comments. In light of Skaalvik and colleagues' assumptions, the results of this study seem to indicate that self-enhancing ego-orientation is more prevalent than self-defeating ego-orientation in the Norwegian PE context. These results may very well be unique to the current context; PE in general lacks well-defined learning criteria, peer performances are constantly on public display, and in Norway, effort counts towards the final grade (Utdanningsdirektoratet, 2015). The students who perceive a greater degree of ego-involving motivational climate may feel compelled to regulate their learning as a response to the unavoidable social comparison that ensues.

The relatively low mean score for self-regulated learning in the current study was interesting. As previously mentioned, the reported score was substantially lower than previously reported figures from different, more academic, school subjects (Pintrich et al., 1993; Saks et al., 2015). No definitive conclusions to the cause of this disparity can be drawn from the data gathered for the purpose of this study; however, postulations are possible. This is by no means an exhaustive list, nevertheless, it would be reasonable to assume that the relative absence of self-regulatory behavior in PE could be attributed to 1) the subject being inherently enjoyable, often drawing comparisons to recess (O'Sullivan, 1989; Kinchin & O'Sullivan, 2003), 2) the lessons having traditionally focused more on displaying skills than learning them (Digelidis, & Papaioannou, 1999; Smith, Lounsbery & McKenzie, 2014), and 3) there being

little or no homework, resulting in minimal expectations of self-initiated extracurricular work (Kinchin & O'Sullivan, 2003; Tannehill, Romar, O'Sullivan, England & Rosenberg, 1994).

From an applied perspective, the findings of this study are of interest to all the stakeholders involved in PE. The lack of clarity concerning the subject's aims and purpose, coupled with the polarizing agendas that determine the curricular execution and modus operandi of the teachers, seem to create confusion concerning expected student behavior. If the students are expected to learn and regulate their own learning, that behavior should be actively facilitated. Policymakers may be satisfied as long as the students are stimulated to be physically active; however, us PE teacher educators should have loftier ambitions. We should acknowledge the formative role we play in shaping the next generation of PE teachers and the influence we have over the subject's direction, and utilize it to promote the application of formative practices and encourage the facilitation of learning enhancing behavior. Preoccupation with anti-sedentary initiatives does not have to be mutually exclusive from learning; however, increases in self-regulatory behavior in an environment dominated by the health agenda without a rebranding of the subject as a learning arena is unlikely. Despite the indications the results of the current study offer, we do not recommend unrestrained reinforcement of ego-involvement and social comparison, due to the negative consequences it might have on motivation, satisfaction and feelings of competence (Braithwaite, Spray, & Warburton, 2011).

We acknowledge that this study has several limitations. Firstly, the cross-sectional nature of this study presents common-method variance problems and excludes any notion of causal attribution. Secondly, self-reporting presents certain obstacles, which can skew the results, such as social desirability and other response biases. However, steps were taken during the data collection to minimize the impact of those phenomena. Thirdly, questions can be raised concerning the generalizability of the results, as the participants were recruited from a

constrained school district. To compensate for the relatively low number of schools and lack of geographical variance, certain measures were made to maximize the representability of the schools. These measures appear to have been successful, as the sample resembled the designated population with reference to age, gender composition, ethnicity, and urban settlement. Moreover, the teacher learning support in PE scale was developed specifically for this study, and despite indications of adequate internal consistency and psychometric properties, further validation is warranted. Finally, the necessary adjustments made to the remaining measurements should be considered when interpreting the results. The modifications make the transfer of external validity and psychometric properties to and from other studies somewhat cumbersome. Nevertheless, the fit indices and internal consistency measures were considered acceptable. Despite these limitations, the results of the study are interesting and have important practical implications. Our recommendations for future research include reproducing the current study in different contexts and examining whether different measures of self-regulated learning yield different results. Even though the 2006 educational reform makes the Norwegian PE context an interesting setting, it also differentiates it from most otherwise compatible contexts, and may make any generalizations across borders fruitless. Randomized control trials determining causal attribution would also be recommended.

Conclusion

Based on the findings of this study, inferences can be made regarding the relationship between teacher dependent environmental factors in PE and the self-regulatory behavior of the students. Firstly, the student's learning behavior appears to be indicative of learning support provided by the teachers. Secondly, an ego-involving motivational climate does not appear to hamper the students' propensity to self-regulate their learning, as suggested by normative goal theory, but rather to stimulate it. Finally, in spite of the teachers engaging in learning enhancing behavior and cultivating a climate where learning is facilitated, the students do not appear to actively

engage in self-regulating behavior in the PE context. This may be due to the inherently enjoyable nature of the subject, and the fact that many students view PE as a welcome break from the quotidian of school life, and not as a learning arena.

References

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, *84*(3), 261-271.

Arnesen, T. E., Nilsen, A. K., & Leirhaug, P. E. (2013). "Den læreplanen som ikkje kan tilpassast mi undervisning, finst ikkje.": vurdering og undervisning i kroppsøving etter kunnskapsløftet. *Tidsskriftet FoU i praksis, 7,* 9-32.

Bentler, P. M., Jackson, D. N., & Messick, S. (1971). Identification of content and style: A two-dimensional interpretation of acquiescence. *Psychological Bulletin, 76*(3), 186-204.

Billiet, J. B., & Davidov, E. (2008). Testing the stability of an acquiescence style factor behind two interrelated substantive variables in a panel design. *Sociological Methods & Research*, *36*(4), 542-562.

Black, P. J. & Wiliam, D. (1998). Inside the black box: raising standards through classroom assessment. *Phi Delta Kappan*, *80*(2), 139-148.

Braithwaite, R., Spray, C. M., & Warburton, V. E. (2011). Motivational climate interventions in physical education: A meta-analysis. *Psychology of Sport and Exercise*, *12*(6), 628-638.

Byrne, B. M. (2012). *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. New York, NY: Routledge.

Cleary, T. J., Platten, P., & Nelson, A. (2008). Effectiveness of the self-regulation empowerment program with urban high school students. *Journal of Advanced Academics*, *20*(1), 70-107.

Cleary, T. J., & Zimmerman, B. J. (2004). Self-regulation empowerment program: A school-based program to enhance self-regulated and self-motivated cycles of student learning. *Psychology in the Schools*, *41*(5), 537-550.

Cothran, D. (2010). Students` curricular values and experiences. In M. O`Sullivan & A. MacPhail (Eds.), *Young People`s Voices in Physical Education and Youth Sport.* (pp. 49-62). London: Routledge.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297-334.

Crum, B. (2012). How to pave the road to a better future for physical education. *Journal of Physical Education & Health-Social Perspective*, *2*(3), 53-64.

Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education*, *15*(1), 3-8.

DeVellis, R. F. (1991). *Scale development: Theory and application*. Newbury Park, CA: Sage.

Digelidis, N., & Papaioannou, A. (1999). Age-group differences in intrinsic motivation, goal orientations and perceptions of athletic competence, physical appearance and motivational climate in Greek physical education. *Scandinavian Journal of Medicine & Science in Sports*, *9*(6), 375-380.

Duda, J. L. (2001). Achievement goal research in sport: Pushing the boundaries and clarifying some misunderstandings. In G. C. Roberts (Ed.), *Advances in motivation in sport and exercise* (pp. 129-182). Champaign, IL: Human Kinetics.

Dugan, R. F., & Andrade, H. L. (2011). Exploring the Construct Validity of Academic Self-Regulation Using a New Self-Report Questionnaire–the Survey of Academic Self-Regulation. *The International Journal of Educational and Psychological Assessment, 7*(1), 45-63.

Duncan, T. G., & McKeachie, W. J. (2005). The making of the motivated strategies for learning questionnaire. *Educational Psychologist*, *40*(2), 117-128.

Ferrer-Caja, E., & Weiss, M. R. (2000). Predictors of intrinsic motivation among adolescent students in physical education. *Research Quarterly for Exercise and Sport*, *71*(3), 267-279.

Forskrift til opplæringsloven. (2006). Forskrift til opplæringsloven [last change: FOR-2018-06-08-845]. Accessed June 19, 2018. https://lovdata.no/dokument/SF/forskrift/2006-06-23-724.

Greene, J. A., Robertson, J., & Costa, L. C. (2011). Assessing self-regulated learning using think-aloud methods. In D. H. Schunk & B. Zimmerman (Eds.), *Handbook of self-regulation of learning and performance* (pp. 313-328). New York, NY: Routledge

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. Florence, KY: Routledge.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of educational research*, *77*(1), 81-112.

Hopfenbeck, T., N. (2014). *Strategier for læring: Om selvregulering, vurdering og god undervisning*. Oslo: Universitetsforlaget.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: a Multidisciplinary Journal*, *6*(1), 1-55.

Jöreskog, K. G. (1969). A general approach to confirmatory maximum likelihood factor analysis. *Psychometrika*, *34*(2), 183-202.

Kinchin, G. D., & O'Sullivan, M. (2003). Incidences of student support for and resistance to a curricular innovation in high school physical education. *Journal of teaching in physical education*, *22*(3), 245-260.

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2011a). The effect of different goals and self-recording on self-regulation of learning a motor skill in a physical education setting. *Learning and Instruction*, *21*(3), 355-364.

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2011b). The effects of instructional and motivational self-talk on students' motor task performance in physical education. *Psychology of Sport and Exercise*, *12*(2), 153-158.

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2012a). The effects of self-talk and goal setting on self-regulation of learning a new motor skill in physical education. *International Journal of Sport and Exercise Psychology*, *10*(3), 221-235.

Kolovelonis, A., Goudas, M., Hassandra, M., & Dermitzaki, I. (2012b). Self-regulated learning in physical education: Examining the effects of emulative and self-control practice. *Psychology of Sport and Exercise*, *13*(4), 383-389.

Leirhaug, P. E. (2016). Exploring the relationship between student grades and assessment for learning in Norwegian physical education. *European Physical Education Review*, *22*(3), 298-314.

López-Pastor, V. M., Kirk, D., Lorente-Catalán, E., MacPhail, A., & Macdonald, D. (2013). Alternative assessment in physical education: a review of international literature. *Sport, Education and Society, 18*, 57-76.

MacNamara, Á., Button, A., & Collins, D. (2010). The Role of Psychological Characteristics in Facilitating the Pathway to Elite Performance Part 2: Examining Environmental and Stage-Related Differences in Skills and Behaviors. *The Sport Psychologist*, *24*, 74-96.

McCaslin, M., Bozack, A.R., Napoleon, L., Thomas, A., Vasques, V., Wayman, V., & Zhang, J. (2006). Self-Regulated Learning and Classroom Management: Theory, Research, and Considerations for Classroom Practice. In C.M. Evertson & C.S. Weinstein (Eds.),

Handbook of Classroom Management: Research, Practice, and Contemporary Issues (pp. 223-252). Malwah: Lawrence Erlbaum Associates.

Moreno-Murcia, J. A., Sicilia, A., Cervelló, E., Huéscar, E., & Dumitru, D. C. (2011). The relationship between goal orientations, motivational climate and selfreported discipline in physical education. *Journal of Sports Science & Medicine*, *10*(1), 119-129.

Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education*, *31*(2), 199-218.

Ommundsen, Y. (2006). Pupils' self-regulation in physical education: The role of motivational climates and differential achievement goals. *European Physical Education Review*, *12*(3), 289-315.

Ommundsen, Y., Roberts, G. C., Lemyre, P. N., & Treasure, D. (2003). Perceived motivational climate in male youth soccer: Relations to social–moral functioning, sportspersonship and team norm perceptions. *Psychology of Sport and Exercise*, *4*(4), 397-413.

O'Sullivan, M. (1989). Failing gym is like failing lunch or recess: Two beginning teachers' struggle for legitimacy. *Journal of Teaching in Physical Education*, *8*(3), 227-242.

O'Sullivan, M. (2004). Possibilities and pitfalls of a public health agenda for physical education. *Journal of Teaching in Physical Education*, *23*(4), 392-404.

O`Sullivan, M., Tannehill, D., Hinchion, C. (2010). Teaching as Professional Inquiry. In R. Bailey (Ed.), *Physical Education for Learning. A Guide for Secondary Schools.* (pp. 54-63.) New York, NY; Continuum.

Panadero, E., Klug, J., & Järvelä, S. (2016). Third wave of measurement in the self-regulated learning field: when measurement and intervention come hand in hand. *Scandinavian Journal of Educational Research*, *60*(6), 723-735.

Papaioannou, A. (1995). Differential perceptual and motivational patterns when different goals are adopted. *Journal of Sport and Exercise Psychology*, *17*(1), 18-34.

Peeters, J., De Backer, F., Reina, V. R., Kindekens, A., Buffel, T., & Lombaerts, K. (2014). The role of teachers' self-regulatory capacities in the implementation of self-regulated learning practices. *Procedia-Social and Behavioral Sciences*, *116*, 1963-1970.

Perry, N. E., & Rahim, A. (2011). Studying self-regulated learning in classrooms. In B. J. Zimmerman & D. H. Schunk (Eds.), Handbook of self-regulation of learning and performance (pp. 122-136). New York: Routledge.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International journal of educational research*, *31*(6), 459-470.

Pintrich, P. R. (2000). The role of goal orientation in self-regulation. In M. Boekaerts, P. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 452-502). New York, NY: Academic Press.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*(1), 33.

Pintrich, P. R., Smith, D. A., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and Psychological Measurement*, *53*(3), 801-813.

Randi, J., & Corno, L. (2000). Teacher innovations in self-regulated learning. In M. Boekaerts, P. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 651-685). New York, NY: Academic Press.

Raykov, T. (1998). Coefficient alpha and composite reliability with interrelated nonhomogeneous items. *Applied Psychological Measurement*, *22*, 375–385.

Sadler, D. R. (2010). Beyond feedback: Developing student capability in complex appraisal. *Assessment & Evaluation in Higher Education*, *35*(5), 535-550.

Saks, K., Leijen, Ä., Edovald, T., & Õun, K. (2015). Cross-cultural adaptation and psychometric properties of the Estonian version of MSLQ. *Procedia-Social and Behavioral Sciences*, *191*, 597-604.

Satorra, A., & Bentler, E. M. (1994). Corrections to Test Statistics and Standard Errors in Covariance Structure Analysis. In A. von Eye, & C. C. Clogg (Eds.), *Latent Variables Analysis: Applications for Developmental Research* (pp. 399-419). Thousand Oaks, CA: Sage.

Seifriz, J., Duda, J. L., & Chi, L. (1992). The relationship of perceived motivational climate to achievement-related affect and cognitions in basketball. *Journal of Sport & Exercise Psychology*, *14*, 375-391.

Skaalvik, E. M. (1997). Self-enhancing and self-defeating ego orientation: Relations with task and avoidance orientation, achievement, self-perceptions, and anxiety. *Journal of Educational Psychology*, *89*(1), 71-81.

Skaalvik, E. M., Valåns, H., & Sletta, O. (1994). Task Involvement and Ego Involvement: relations with academic achievement, academic self-concept and self-esteem. *Scandinavian Journal of Educational Research*, *38*, 231-243.

Smith, N. J., Lounsbery, M. A., & McKenzie, T. L. (2014). Physical activity in high school physical education: impact of lesson context and class gender composition. *Journal of Physical Activity and Health*, *11*(1), 127-135.

Solmon, M. A. (1996). Impact of motivational climate on students' behaviors and perceptions in a physical education setting. *Journal of Educational Psychology*, *88*(4), 731.

Tay, H. Y. (2015). Setting formative assessments in real-world contexts to facilitate self-regulated learning. *Educational Research for Policy and Practice*, *14*(2), 169-187.

Tannehill, D., Romar, J. E., O'Sullivan, M., England, K., & Rosenberg, D. (1994). Attitudes toward physical education: Their impact on how physical education teachers make sense of their work. *Journal of Teaching in Physical Education*, *13*(4), 406-420.

Theodosiou, A., & Papaioannou, A. (2006). Motivational climate, achievement goals and metacognitive activity in physical education and exercise involvement in out-of-school settings. *Psychology of Sport and Exercise*, *7*(4), 361-379.

Torrano Montalvo, F., & González Torres, M. (2004). Self-regulated learning: Current and future directions. *Electronic Journal of Research in Educational Psychology, 2*(1), 1-34.

Tveit, S. (2014). Educational assessment in Norway. *Assessment in Education: Principles, Policy & Practice*, *21*(2), 221-237.

Utdanningsdirektoratet. (2015, 08.01). Lærerplan i kroppsøving. Retrieved from http://data.udir.no/kl06/KRO1-04.pdf

Wang, M. T., & Holcombe, R. (2010). Adolescents' perceptions of school environment, engagement, and academic achievement in middle school. *American Educational Research Journal 47*(3), 633-662.

Winne, P. H., & Perry, N. E. (2000). Measuring self-regulated learning. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of Self-Regulation* (pp. 531-566). Orlando, FL: Academic Press.

Yang, Y., & Green, S. B. (2010). A note on structural equation modeling estimates of reliability. *Structural Equation Modeling: A Multidisciplinary Journal*, *17*, 66–81.

Young, M. R. (2005). The motivational effects of the classroom environment in facilitating self-regulated learning. *Journal of Marketing Education*, *27*(1), 25-40.

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology*, *81*(3), 329-339.

Zimmerman, B. J. (1998). Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 1-19). New York, NY: Guilford Publications.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-39).

Zimmerman, B. J. (2002). Becoming a Self-Regulated Learner: An Overview. *Theory into Practice*, *41*(2), 64-70.

Zimmerman, B. J. (2006). Development and Adaptation of Expertise: The Role of Self-Regulatory Processes and Beliefs. In K. A. Ericsson, N. Charness, P. J. Feltovich, & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 705-722). New York, NY: Cambridge University Press.

Zimmerman, B. J. (2008). Investigating Self-Regulation and Motivation: Historical Background, Methodological Developments, and Future Prospects. *American Educational Research Journal, 45*(1), 166-183.

Zimmerman, B. J., & Pons, M. M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *American educational research journal*, *23*(4), 614-628.

Zimmerman, B. J., & Pons, M. M. (1988). Construct validation of a strategy model of student self-regulated learning. *Journal of educational psychology*, *80*(3), 284-290.

Appendix

Unverified English language version of the TLS scale

In this PE class…

1. The PE teacher informs us as to what we are supposed to learn
2. The PE teacher provides us with clear aims for the lesson, and tells us what is expected of us
3. The PE teacher gives feedback that is indicative of the quality of our work
4. The PE teacher provides us with clear advice on how we can improve our performance
5. It is important to the PE teacher that we learn new activities
6. The PE teacher gives us open tasks that give us the opportunity to try various solutions
7. The PE teacher listens to our commentary and takes it into account during the lessons
8. The PE teacher gives us the opportunity to evaluate our own effort and development
9. The PE teacher concludes the lesson with a short recap of what we learned during that lesson*

Original Norwegian version of the TLS scale

I kroppsøvingstimene…

1. Informerer læreren oss om hva vi skal lære
2. Presenterer læreren klare mål for timen, og hva som blir forventet av oss
3. Gir læreren tilbakemeldinger som forteller om kvaliteten på vårt arbeid
4. Gir læreren tydelige råd om hvordan vi kan forbedre våre prestasjoner
5. Er læreren opptatt av at vi lærer nye aktiviteter
6. Gir læreren åpne oppgaver hvor vi kan prøve ut ulike løsninger
7. Er læreren lydhør for våre tilbakemeldinger, og tar hensyn til denne i senere undervisning
8. Gir læreren oss mulighet til å vurdere eget arbeid og egen faglig utvikling
9. Avslutter læreren timene med en kort samtale om hva vi har lært i dagens økt*

*not included in the final version of the scale due to modest contribution to the construct

Tables and figures

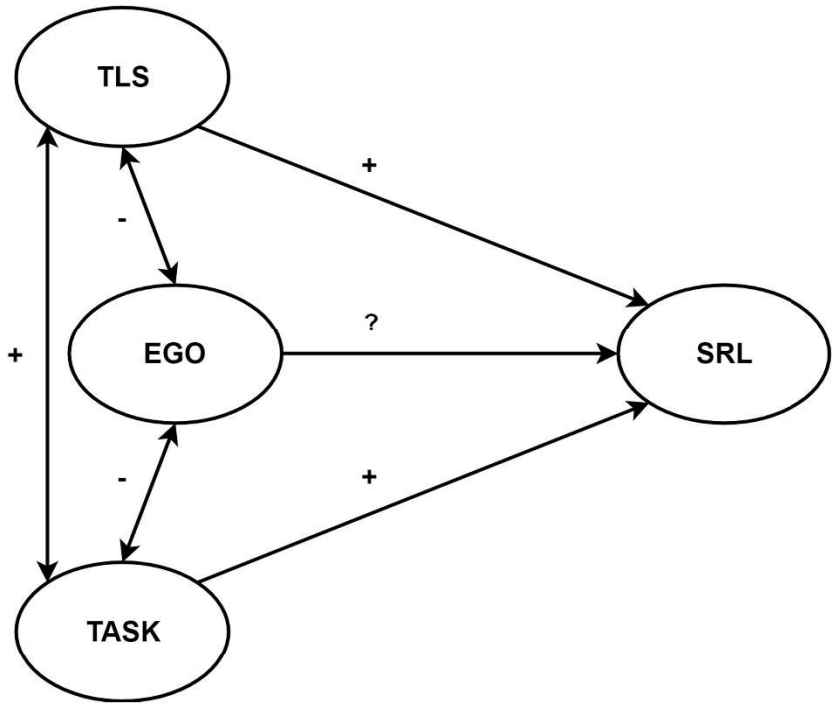

Figure 1. A hypothesized model for the study (TLS = teacher learning support, EGO = ego-involving motivational climate, TASK = task-involving motivational climate, SRL = self-regulated learning).

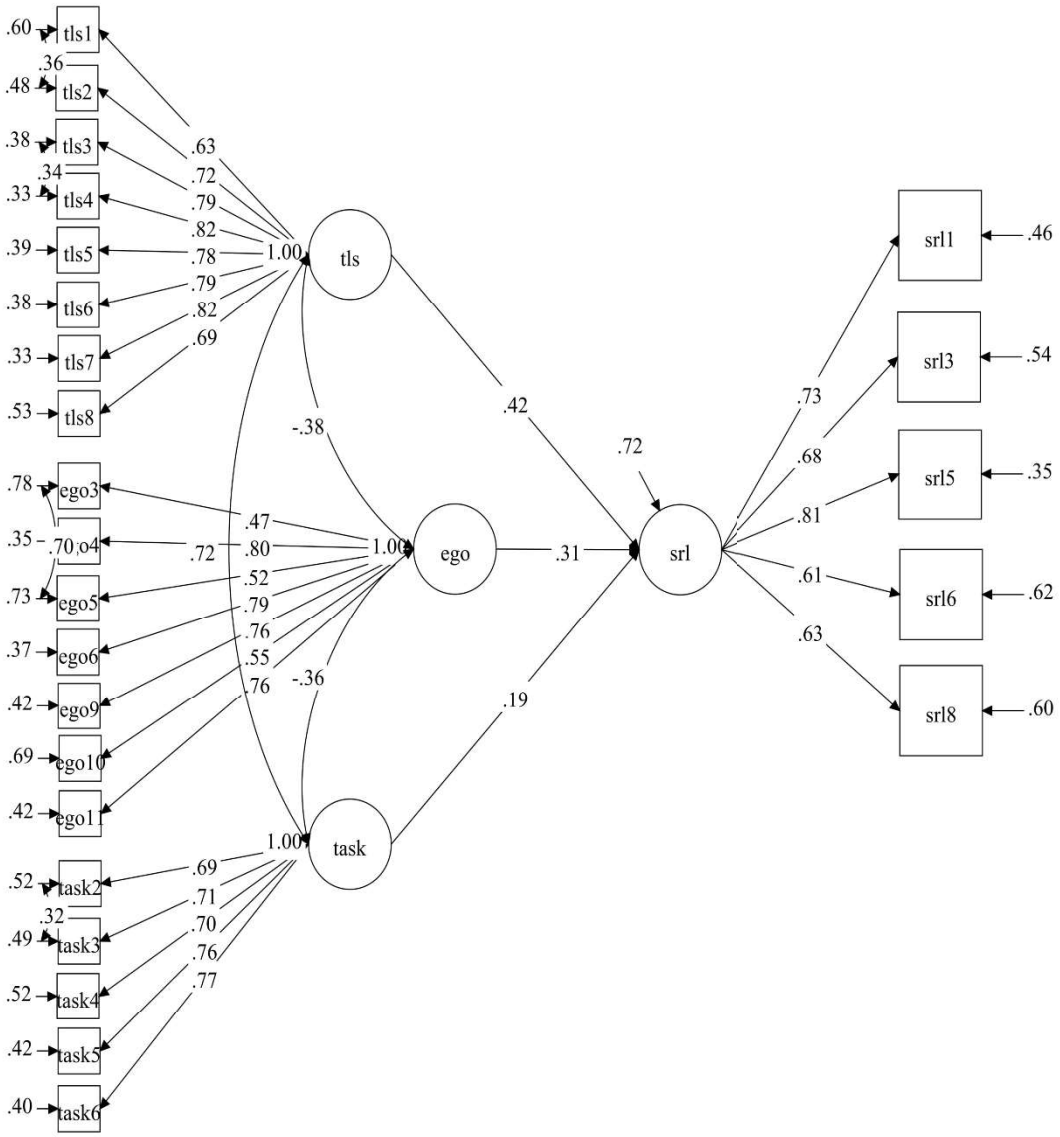

Figure 2. A visual representation of the standardized β coefficients for the complete model. As illustrated by the missing items, the EGO, TASK and SRL scales have been tolerably modified.

Table 1. Descriptive statistics, Raykov's rho coefficients and correlations for all latent variables

	Mean	SD	Range	Raykov's ρ	1.	2.	3.
1. Self-regulated learning	3.14	1.32	1-7	.82	-		
2. Teacher learning support	4.21	1.09	1-6	.91	.39**		
3. Task-involving climate	3.85	.76	1-5	.85	.28**	.60**	
4. Ego-involving climate	2.34	.85	1-5	.85	.11*	-.28**	-.27**

Note: Reported values represent the modified scales, bivariate correlation is indicated using Spearman's ρ, * $p < .05$, ** $p < .01$