Chapter 12
Can Being Autonomy-Supportive in Teaching Improve Students' Self-Regulation and Performance?

John Chee Keng Wang, Betsy L.L. Ng, Woon Chia Liu, and Richard M. Ryan

Introduction

Within self-determination theory (SDT; Deci & Ryan, 1985), learners' intrinsic motivation is said to be facilitated and enhanced by nurturing their innate psychological needs for autonomy, competence and relatedness. These three basic needs relate to choice, feeling of effectiveness and connectedness. Satisfaction of the needs within a context will promote intrinsic motivation for doing a task or activity. Through experiencing a sense of choice in learning, a sense of competence as well as a sense of connectedness, learners feel self-determined (autonomous) and motivated.

Studies in the SDT literature have provided the benefits associated with learners' need satisfaction and teacher's autonomy support (Gagne, 2003; Jang, Kim, & Reeve, 2012). Satisfaction of needs provides the condition for optimal learning by yielding an energizing effect in which learners can get more fully immersed in the learning process and predicts positive learning outcomes (Reeve, Deci, & Ryan, 2004). Despite the documented existence of SDT-based intervention research, little is known about the inclusion of motivational-cognitive variables. The aim of this study was to test the effects of the autonomy-supportive classroom intervention on student learning outcomes in terms of needs satisfaction, motivational-cognitive factors and academic achievement in the Singapore context.

J.C.K. Wang • B.L.L. Ng (✉) • W.C. Liu
National Institute of Education, Nanyang Technological University, Singapore, Singapore
e-mail: john.wang@nie.edu.sg; n_betsy@hotmail.com; woonchia.liu@nie.edu.sg

R.M. Ryan
Institute for Positive Psychology and Education, Faculty of Health Sciences,
Australian Catholic University, Strathfield, NSW, Australia
e-mail: richard.ryan@acu.edu.au

W.C. Liu et al. (eds.), *Building Autonomous Learners*,
DOI 10.1007/978-981-287-630-0_12

SDT-Based Educational Research

SDT is a macro-theory on human motivation, in particularly autonomous motivation, controlled motivation and amotivation which are used as predictors of academic performance (Deci & Ryan, 2008). Recent empirical studies support the associations of autonomous motivation with achievement and engagement (De Naeghel et al., 2012; Reeve, 2013), the positive impact of teacher need support on motivation and learning (Diseth, Danielsen, & Samdal, 2012; Jang et al., 2012) as well as the relationship between student need satisfaction and intrinsic motivation (Brooks & Young, 2011; Otoshi & Heffernan, 2011).

From the SDT perspective, autonomy-supportive teachers permit students to act upon their personal interests and values, to provide students with the desired amount of choice and to give a meaningful rationale when choice is constrained (Soenens et al., 2007). Such teachers are effective in supporting students' need for autonomy as they can empathetically adopt learners' internal frame of reference (i.e. autonomy support). Autonomy-supportive teachers also satisfy students' needs for competence; thereby students might be more engaged in self-regulated learning (Sierens et al., 2009). Autonomy support is likely to allow a more student-attuned learning environment as it acts in accordance with students' goals.

According to Deci and his colleagues (Deci, Eghari, Patrick, & Leone, 1994), an autonomy-supportive environment is when the leader provides rationale, acknowledgement of conflict and choice. Autonomy-supportive environment facilitates more self-determined forms of motivation in students as opposed to controlling behaviours. Controlling behaviours arise in a controlled environment whereby two of the three critical abovementioned factors are absent. Therefore, the utility of applying SDT to educational settings is evident whereby students thrive in both academic and developmental domains.

Determinants of Motivation and Self-Regulated Learning

Perceived autonomy support can facilitate autonomous learning, which will lead to self-determined behaviours and greater well-being (Levesque, Zuehlke, Stanek, & Ryan, 2004). To measure the extent to which individuals are relatively autonomous versus controlled in performing a task or activity, the Academic Self-Regulation Questionnaire (SRQ-A) was developed by Ryan and Connell (1989). This self-report questionnaire provides statements asking the rationale in engaging specific behaviours that vary along the autonomy-control continuum. By combining the ratings based on the degree of each regulatory style, a summary score called the relative autonomy index (RAI) can then be computed. High RAI scores in educational settings related to more autonomous learning but also predicted positive educational outcomes including competence and enjoyment of school (Miserandino, 1996; Williams & Deci, 1996).

Two other tenets that contribute to autonomous learning are motivational beliefs and self-regulatory strategies. More specifically, positive motivational beliefs such as high self-efficacy and task value and low level of test anxiety can aid in engagement of deep processing and metacognitive regulation (Pintrich, Smith, Garcia, & McKeachie, 1993). Conversely, self-regulatory strategies help students focus on planning, monitoring and controlling their cognition (Pintrich, 2000). In accordance with the active learner's beliefs and cognition, the Motivated Strategies for Learning Questionnaire (MSLQ) was developed (Pintrich et al., 1993) to evaluate self-regulatory skills and to predict academic performance. In relation to this, MSLQ can be used to measure students' motivational beliefs and self-regulated learning in academic context.

A recent local research study (Wang, Liu, Koh, Tan & Ee, 2011) demonstrated students' perceived basic psychological needs, motivational factors and achievement in project work across a three-point period. The context of project work had facilitated the psychological needs of students as well as enhanced students' motivation, learning strategies and achievement in project work. Their findings highlighted the nature of a learning context (i.e. project work) could foster optimal learning in students. However, other social factors such as autonomy-supportive interpersonal behaviours are also important.

Several studies used the MSLQ and Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989) to measure students' perceived self-regulatory skills and their enjoyment, respectively (Ee, Wang, Koh, Tan, & Liu, 2009; Van Nuland, Dusseldorp, Martens, & Boekaerts, 2010). Their findings revealed that self-regulatory skills (i.e. metacognition) and enjoyment had positive influence on academic performance. Besides the importance of self-regulatory skills, the learning climate may support or thwart students' learning. As proposed by Vallerand, Pelletier and Koestner (2008), there is a need to study the effect of social factors on individuals' needs and motivational orientations in education. Such research is necessary as previous studies reported high self-determined forms of motivation (i.e. intrinsic motivation) versus low levels of extrinsic motivation from undergraduates.

In this study, some of the motivational and self-regulated learning constructs of MSLQ were selected to examine students' beliefs and use of learning strategies in their academic subjects. By understanding their motivational beliefs and learning strategies, the MSLQ can be used to predict students' grades in academic subjects such as mathematics and science.

Autonomy-Supportive Interventions

Su and Reeve's (2011) recent meta-analysis supported the effectiveness of autonomy-supportive intervention in terms of helping people to support the autonomy of others. In these 19 studies, the unit of analysis in most autonomy-supportive trainings is the individual teacher, parent, manager, coach or clinician. In contrast to practice, interventions are often carried out at a macro-level such as at the level of

the school, corporation or hospital. Results from these intervention studies indicated that laboratory settings were more effective and relatively consistent than authentic settings such as schools had more diverse results. In this vein, it is necessary to test the effectiveness of teacher's autonomy-supportive instructional behaviours on student motivation and learning.

Based on existing knowledge, limited empirical studies have examined the effects of autonomy-supportive teaching style on student motivation and self-regulated learning in academic contexts. Most school-based intervention studies focused on leisure-time physical activities and physical education. For instance, Chatzisarantis and Hagger (2009) evaluated the utility of school-based intervention to increase student physical activity participation over a 5-week interval of time. Their study employed two conditions: (1) teachers in the treatment condition were trained to adopt an autonomy-supportive teaching style during physical education classes, and (2) teachers in the control condition were instructed to adopt a less autonomy-supportive teaching style. Results indicated that students in the treatment condition exhibited stronger intentions and higher frequency to exercise during leisure time than those in the control condition. According to a recent intervention study in a physical education setting (Tessier, Sarrazin, & Ntoumanis, 2010), teacher interpersonal involvement (i.e. interactions with students) was salient in autonomy-supportive behaviours, thus promoting students' psychological need satisfaction in relatedness, but not in autonomy and competence. This calls for the potential research to examine how students perceived autonomy-supportive teaching behaviours that may influence their needs satisfaction.

In regard to autonomy-supportive intervention in classroom settings, Reeve and colleagues (2004) observed how trained teachers in autonomy-supportive behaviours engage their students' learning in an experimental group versus the untrained teachers in a control group. Their findings demonstrated enhanced engagement in students through classroom observations. Likewise, Furtak and Kunter (2012) conducted an autonomy-supportive intervention through a reform-based science lesson on motion. It was a small-scale research evaluating the effect of procedural and cognitive autonomy-supportive teaching on student motivation and learning. Enhanced motivation and improved achievement test score demonstrated the effect of cognitive autonomy-supportive teaching.

The Present Study

The abovementioned evidence indicated that teachers being autonomy-supportive can better facilitate students' psychological needs and autonomous learning behaviours. However, further research is needed to address the research gaps in previous studies. The purpose of this study is to test the effectiveness of an autonomy-supportive intervention that provide rationale, feedback, choice and acknowledgement of personal conflicts versus a control group whereby the teachers will conduct their lessons per se. The following hypotheses were formulated:

H1 Autonomy-supportive intervention would have a positive effect on perceived autonomy support, basic psychological needs and relative autonomy.

H2 Autonomy-supportive teaching style would have a positive effect on the students' motivational beliefs and learning strategies.

H3 Students with perceived autonomy support would have enhanced effort exertion, intrinsic interest and grades in the academic context.

Method

Participants

Eight local schools from Singapore with 393 secondary school students ($M = 15.3$, $SD = 1.25$, age range from 13 to 17 years) participated in the present study. Of these, 213 were males whereas 175 were females. With a total of 16 classes, each school had two intact classes, namely, one control group and one intervention group. Permission was granted to the researchers to conduct the research in the classroom setting of each school and confidentiality of the participants' responses was assured. The pre- and post-intervention questionnaires were administered in a quiet classroom condition. Note that English was the medium of instruction for all participating schools.

Procedure

This study adopted a 5-week intervention design from Chatzisarantis and Hagger (2009). At pre-intervention, eight teachers in the treatment condition (i.e. intervention) were trained to adopt an autonomy-supportive interpersonal style according to Reeve's (2009) five acts of instructional behaviour: (1) offering choices and options, (2) providing explanatory rationales, (3) giving feedback through informational, non-controlling language, (4) allowing time for self-paced learning to occur as well as (5) acknowledging students' expressions of negative affect.

The training was conducted on four sessions with 3 h per session, over a month by an expert in SDT. The trained teachers implemented their autonomy-supportive teaching style during the 5 weeks of intervention. The control group comprised of the remaining eight teachers whose classes had no implementation of the treatment condition. These teachers were not randomly assigned to experimental conditions to avoid any class disruption in schools. At pre- and post-intervention, data collection was based on the students' responses from the self-report measures in terms of mathematics, science as well as design and technology (D&T) contexts.

Measures

The pre- and post-intervention questionnaires contained all the following self-report measures (except for grades). A 7-point scale format, ranging from 1 (not true at all) to 7 (very true of me), was used for all measures (except grades).

Learning Climate Questionnaire (LCQ)

Perceived teacher's autonomy support was measured using the 15-item LCQ (Williams & Deci, 1996). An example of the items was "I feel that my teacher provides me choices and options". Students responded the questionnaire in accordance with the degree to which they perceived their teacher's autonomy-supportive interpersonal style. The mean scores of students' responses were then computed.

Academic Self-Regulation Questionnaire (SRQ-A)

The Academic Self-Regulation Questionnaire (SRQ-A; Ryan & Connell, 1989) was used to measure the motivational orientations in the context of academic subjects. The adapted fourteen items represented an autonomous motivational style (identified regulation, intrinsic motivation) and a controlling motivational style (external regulation, introjection). An example of the items that measured identified regulation was "because I want to improve in project work", intrinsic motivation was "because project work is fun", for external regulation included "because I'll get into trouble if I don't" and, lastly, introjection was "because I'll feel bad about myself if I didn't". The relative autonomy index (RAI) was computed to evaluate students' autonomous motivation in the academic contents. RAI was calculated by external regulation × (−2) + introjection × (−1) + identification + intrinsic motivation × (2). Higher RAI score indicates a more autonomous motivational orientation of the individual.

Basic Psychological Needs Scale

To measure students' autonomy, competence and relatedness need satisfaction, the Basic Psychological Needs Scale (Liu et al., 2009) was used. It comprised of 12 items, namely, 6 items for autonomy (e.g. "I feel that my teacher provides me with choices and options in school"), 3 items for competence (e.g. "In school, I feel pretty competent") as well as 3 items for relatedness (e.g. "I feel close to my school mates").

Motivated Strategies for Learning Questionnaire

In this study, 28 items were selected from the 44-item MSLQ (Pintrich & De Groot, 1990) to measure junior high students' motivational beliefs and their learning strategies. As the intention of the study was to test if autonomy-supportive teaching style would have a positive effect on the students' motivational beliefs and learning strategies, the selected items included the following six scales: self-efficacy (e.g. "Compared with other students in this class I expect to do well"; five items), task value (e.g. "I prefer class work that is challenging so I can learn new things"; six items), test anxiety (e.g. "I am so nervous during a test that I cannot remember facts I have learned"; four items), rehearsal (e.g. "When I study for a test I practice saying the important facts over and over to myself"; four items), elaboration (e.g. "When reading I try to connect the things I am reading about with what I already know"; five items) and metacognitive self-regulation (e.g. "When I am studying a topic, I try to make everything fit together"; four items).

Intrinsic Motivation Inventory (IMI)

The measurement of the students' learning outcome in terms of enjoyment and effort was represented by "intrinsic value" and "effort exertion". To measure students' intrinsic value (i.e. enjoyment) and effort exertion, two relevant subscales from the IMI (McAuley et al., 1989) were used. Intrinsic value was assessed by the four items from the IMI interest/enjoyment subscale (e.g. "I would describe school as very interesting") and effort was measured by three items (e.g. "I put a lot of effort into my school work").

Grades

At pre- and post-intervention, students' term test grades for mathematics, science as well as D&T were collected.

Data Analysis

Data analyses were performed using IBM SPSS Statistics 20. In the main analysis, three repeated-measures MANOVA and follow-up ANOVAs were conducted, followed by post hoc tests using Bonferroni. A separate ANOVA was conducted for academic grades between groups. As the sample sizes for classes and teachers were considered small, the student participants were used as the unit of analysis and multilevel analysis was not conducted.

Results

Perceived Autonomy Support, Basic Needs and RAI

Repeated-measures MANOVA with perceived autonomy support, basic needs and RAI as dependable variables, time of measurement as the within-subjects factor (within group) and group as the between-subjects factor was performed on the two groups (i.e. control versus intervention). The results revealed significant between-group effect, Wilk's $\Lambda = 0.959$, $F(5, 365) = 3.10$, $p < 0.01$ and $\eta^2 = 0.04$; within-group effect, Wilk's $\Lambda = 0.942$, $F(5, 365) = 4.46$, $p < 0.01$ and $\eta^2 = 0.06$; as well as time × group interaction effect, Wilk's $\Lambda = 0.946$, $F(5, 365) = 4.20$, $p < 0.01$ and $\eta^2 = 0.05$.

Subsequent univariate tests showed significant within-group effects for perceived autonomy support, $F(1, 359) = 5.93$, $p < 0.05$ and relatedness, $F(1, 359) = 2.92$, $p < 0.05$; significant interaction effects for perceived autonomy support, $F(1, 359) = 14.9$, $p < 0.01$ and RAI, $F(1, 359) = 8.49$, $p < 0.01$; as well as between-group effect for competence, $F(1, 359) = 7.41$, $p < 0.01$. The ANOVA results demonstrated that students' perceived autonomy support, autonomy, competence and RAI increased from the pre- to post-intervention, as compared to those in the control group. However, the change for autonomy was not significant. Table 12.1 shows the means, standard deviations and effects for the outcome measures in the two groups.

MSLQ Variables

Repeated-measures MANOVA with MSLQ variables (i.e. intrinsic value, self-efficacy, learning strategies, lack of self-regulation and anxiety) as dependable variables, time of measurement as the within-subjects factor (within group) and group as the between-subject factor was performed on the two groups (i.e. control versus intervention). The multivariate results for MSLQ variables showed significant effects of group, Wilk's $\Lambda = 0.968$, $F(5, 373) = 2.43$, $p < 0.05$ and $\eta^2 = 0.032$, and

Table 12.1 Repeated-measures MANOVA for perceived autonomy support, basic needs and RAI

	Control group				Intervention group				
	Pre		Post		Pre		Post		Effect
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Autonomy support	4.55	1.14	4.45	1.05	4.38	1.05	4.75	1.19	*T/*I
Autonomy	4.50	1.03	4.45	0.93	4.52	0.89	4.69	1.01	–
Competence	4.43	1.15	4.36	1.06	4.60	1.04	4.73	1.13	*G
Relatedness	4.90	1.05	4.68	0.94	4.87	1.01	4.84	1.04	*T
RAI	1.58	4.53	0.66	3.77	2.17	4.62	2.40	4.29	*I

*T, time effect; *I, interaction effect; *G, group effect; –, no effect

Table 12.2 Repeated-measures MANOVA for MSLQ subscale measures

	Control group				Intervention group				
	Pre		Post		Pre		Post		Effect
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Intrinsic values	4.77	1.23	4.74	1.11	4.94	1.07	5.15	1.13	–
Self-efficacy	4.11	1.21	4.19	1.14	4.11	1.09	4.47	1.20	*T/*I
Learning strategies	4.62	1.12	4.64	1.02	4.65	1.07	4.83	1.04	–
Lack of self-regulation	4.28	1.22	4.09	1.12	4.55	1.26	4.23	1.29	*T
Anxiety	4.04	1.20	4.05	1.23	3.92	1.26	4.08	1.33	–

*T, time effect; *I, interaction effect; –, no effect

within-group effects, Wilk's $\Lambda = 0.940$, $F(5, 373) = 4.81$, $p < 0.05$ and $\eta^2 = 0.061$, but no significant effect on time × group interaction.

It was hypothesized that the autonomy-supportive intervention would have a positive effect on the MSLQ variables. Subsequent univariate tests revealed significant within-group effects for self-efficacy, $F(1, 357) = 15.18$, $p < 0.01$ and lack of self-regulation, $F(1, 357) = 8.18$, $p < 0.01$, as well as interaction effect for self-efficacy, $F(1, 357) = 7.81$, $p < 0.01$. The main effect of teacher's autonomy support on self-efficacy was significant such that students scored higher level of self-efficacy for the intervention, compared to those in control condition. The ANOVA results demonstrated that students' intrinsic value, learning strategies and anxiety increased from the pre- to post-intervention, as compared to those in the control group. However, the change for these variables was not significant. Table 12.2 shows the means, standard deviations and effects for the outcome measures in the two groups.

IMI Variables and Grade

Repeated-measures MANOVA with two dependent variables on IMI was conducted. There was a significant multivariate effect of group for effort and interest, Wilk's $\Lambda = 0.960$, $F(2, 370) = 7.70$, $p < 0.01$ and $\eta^2 = 0.04$. However, the within-group differences and time × group interaction had no significant effect. Subsequent univariate ANOVA also yielded no significant effects.

It was hypothesized that the autonomy-supportive intervention would have a positive effect on perceived effort, interest and grades. A mixed-method ANOVA results conducted for grades showed that students in the intervention group scored higher ($F(1, 280) = 13.08$, $p < 0.01$, $\eta^2 = 0.05$) than those in control group. In addition, there was a significant interaction effect, $F(1, 280) = 4.76$, $p < 0.05$ and $\eta^2 = 0.02$. However, there was no significant effect for within-group grades. Table 12.3 shows the descriptive statistics and effects for the outcome measures in the two groups.

Table 12.3 Repeated-measures MANOVA for IMI subscale measures/mixed-method ANOVA for grades

	Control group				Intervention group				
	Pre		Post		Pre		Post		Effect
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Effort exertion	4.81	0.98	4.69	0.91	4.93	1.09	4.92	1.08	–
Intrinsic interest	4.61	1.28	4.55	1.15	5.01	1.21	4.99	1.23	–
Grade	61.05	16.99	57.98	20.72	65.46	13.81	66.62	16.69	*G/*I

*I, interaction effect; *G, group effect; –, no effect

Discussion

The purpose of the present study was to assess the effectiveness of the autonomy support intervention in enhancing perceived autonomy support, students' motivational orientations and learning strategies. This study also evaluates the perceptions of students' needs of satisfaction, effort and interest in studying mathematics, science and D&T. In line with the research studies that emphasized the centrality of autonomy support for students' higher levels of psychological needs (Reinboth & Duda's, 2006; Vansteenkiste et al., 2009), the 5-week intervention had significant positive effects on students' perceived autonomy support, competence and relatedness. In addition, there were significant interaction effects on students' perceived autonomy support, RAI, self-efficacy and achievement. Results are discussed in light of the three aforementioned hypotheses.

Changes in Students' Perceived Autonomy Support, Needs and Relative Autonomy

The autonomy-supportive intervention was successfully implemented, as indicated by the significant increase in perceived autonomy support. Despite the positive change in perceived autonomy support, this may not be sufficient to propel students' autonomy emanating from being in a classroom setting, as indicated by the insignificant change in perceived autonomy. When students feel that doing schoolwork is due to some external coercion, they do not experience the need for autonomy (Urdan & Schoenfelder, 2006), suggesting that an internal perceived locus of causality is more relevant to the need of autonomy towards academic learning.

On the other hand, when students perceive the need for competence, they will experience efficacy upon completion of a learning task (Sierens et al., 2009). This corresponds with the increased level of students' reported competence in this intervention study. Autonomy-supportive teachers provide structure that will provide competence-relevant feedback and express confidence in students' abilities towards

completion of tasks (Reeve et al., 2004). Research on SDT applied in educational settings supported that autonomy-supportive teachers facilitate students' need for competence and nurture students' need for relatedness, which are beneficial in both academic and development domains. The significant increased level of students' relatedness suggests that students could relate to teacher's effortful engagement. When teachers support students' autonomy in classroom learning, such engagement provided students with information about teachers' commitment to students' well-being (McHugh, Horner, Colditz, & Wallace, 2013). These perceptions may relate to students' fulfilment of need for relatedness.

Previous studies (Deci et al., 1994; Williams & Deci, 1996) advocated that autonomy demonstrated increased autonomous learning and greater relative autonomy. Within the SDT framework, the positive impact of autonomy support is when children self-regulated in an integrated manner such that they acted in accord to their feelings and thoughts of the task (Joussemet, Koestner, Lekes, & Houlfort, 2004). This explains the overall significant effect of the autonomy-supportive teaching approach on students' relative autonomy. This might be explained by the students' perceived autonomy support from their teachers, resulting in students being more autonomous and self-regulated in their learning.

Changes in Student Motivational-Cognitive Measures

Regarding the MSLQ variables, the results partially confirmed the second hypothesis, as shown by the significant positive and interaction effects of self-efficacy. On the contrary, there was no significant effect on students' intrinsic value, use of learning strategies and anxiety between the autonomy-supportive teaching approach and control condition. One possible explanation could be due to the routine school tasks. The perception of task value is similar to that of intrinsic value which assesses students' perceptions that the content of their classes is interesting, relevant and important to them (Anderman, 2003). Likewise, when the task is perceived as being closely connected to individuals' values and interests, they portray stronger feelings of autonomy (Katz & Assor, 2007). However, only one significant interaction effect between the teaching approach and students' self-efficacy was found. This suggests that autonomy-supportive teachers could affect changes in students' self-efficacy beliefs in terms of enhancing their self-efficacy with regard to classroom activities and subjects (Wigfield, Guthrie, Tonks, & Perencevich, 2004). Previous research by Williams et al. (2004) proposed that autonomy may have an indirect effect on outcomes through self-efficacy beliefs. However, further research is needed to test this relationship.

Research studies (Sierens et al., 2009; Vansteenkiste et al., 2009) have shown that autonomy-supportive teaching style was associated with students' management of their classroom learning and self-regulated learning strategies. In contrast to this study, the insignificant effect on the learning strategies variable suggests that students in both control and intervention groups could control and apply effective

learning strategies. Such strategies can be constructed from experience or facilitate by teachers and peers (Paris & Newman, 1990). Consequently, the significant decrease for lack of self-regulation between groups demonstrated an improvement in self-regulation of students from the intervention group. Recent empirical findings (Jang, Reeve, & Deci, 2010; Soenens et al., 2012) confirmed that students became more self-regulated learners when the learning climate was autonomy-supportive. Nonetheless, students still experienced anxiety in both control and intervention groups. As stated by Pajares (2005), students can feel a fairly good sense of their confidence as they contemplate an action. Although negative feelings provide cues that something is amiss, one may not be aware of such case. Hence, negative feelings such as anxiety still exist in students and teachers can help to decrease anxiety by increasing a student's attention to the task at hand (Britner & Pajares, 2006). When a mind is well-focused on the dynamics of the task, the shift of focus to apprehension can be avoided, hence reducing the level of anxiety.

Changes in Student Effort, Interest and Achievement

An important finding arose in this study is that the autonomy-supportive teaching style did not affect students' effort regulation and intrinsic interest in their schoolwork. This phenomenon confirms the view advocated by Legault et al. (2006) in which students are amotivated in schools based on their effort beliefs, value placed on academic tasks and characteristics of the academic tasks. Alternatively, by fostering relevance of school tasks to students, autonomy-supportive teachers can help students to become autonomous and discover how extrinsically motivated academic tasks can become relevant to their interests (Assor, Kaplan, & Roth, 2002). In addition, students' enjoyment and valuing of their academic subject may be related to their perceived needs satisfaction (Liu et al., 2009). Findings reported in this study suggest that the lack of enjoyment (i.e. intrinsic interest) and effort in the school work could relate to students' perceived autonomy. Next, the significant interaction effect between the teaching approach and grades might be explained by students who endorsed autonomy support at the beginning of the 5-week benefit most from the intervention. This is consistent with previous research findings (Blackwell, Trzesniewski, & Dweck, 2007).

Overall, there was a significant time × group interaction effect for each variable – perceived autonomy support, RAI, self-efficacy and grades. Findings of this study indicated that the intervention was successful in terms of significant changes in the desired learning outcomes. Specifically, individuals in the intervention group were more autonomous and self-efficacious as well as more autonomy support than individuals in the control group. Subsequently, the intervention group had significantly improved students' grades of academic subjects. Evidently, the findings of this study suggest that feeling of self-efficacy is facilitated by autonomy-supportive contexts. Nevertheless, there are still implications and limitations to be considered when implementing future intervention studies.

Practical Implications

This present study examined the effects within groups and between groups. The rationale of within-group effects is that students' perceptions of the classroom climate are key factors in predicting the students' motivation and learning outcomes (Jang et al., 2010). Hence, the students' perceptions of their teachers' interpersonal behaviours and their own learning behaviours are important variables. By examining the between-group effects, the emphasis is on classroom climate and teacher's interpersonal behaviour. The findings of between-group effects can be considered as an important socio-contextual contribution which adds on to the current literature of autonomy support.

As the control groups comprised of students from eight schools, the interpretation of the learning context may be divergent. Previous studies have shown that students in the same grade will often interpret classroom goal structures or teacher's expectations in divergent way (Urdan & Midgley, 2003). It should be noted that students may interpret the challenges or requirements of specific contexts to be more important than actual learning context. This implies that students' learning in the classroom environment may be more influenced by a variety of factors (interpersonal, emotional and cultural) than the cognitive factors associated with classroom learning. This conjecture seems to be in line with an earlier finding by effectiveness of teacher's behaviour (Den Brok, Brekelmans, & Wubbels, 2004), suggesting that certain teacher's behaviour might have different effects in one subject sample or one outcome measure as compared to another. In addition, there was a strong association between proximity and students' subject-specific motivation but no association with students' cognitive test scores was found.

Based on current findings, autonomy-supportive training programme is likely to influence teachers' teaching style. However, it is important to consider teachers' beliefs before the training, as teachers' beliefs may affect their autonomy-supportive teaching styles. Understanding teachers' beliefs about the utility of autonomy-supportive teaching may predict how effective and how easy-to-implement autonomy-supportive teaching styles.

Limitations and Conclusion

There are several limitations in the present study. First, the absence of the effects for students' reported autonomy, intrinsic values and effort may reflect the constraints of the nature and choice of school tasks. The task and learning context might lack of motivational components such that students did not endorse interest and enjoyment. Furthermore, sense of autonomy may be enhanced through choice of tasks and use of neutral language during teacher-student communication. For future study, adequate measures of the learning context may be included to overcome this limitation.

Another limitation is the lack of random assignment of teachers to experimental conditions. It is difficult to employ random assignment due to period of implementation and school contextual issues that could not controlled for in this study. Future intervention research should consider random assignment as the results are likely to be much more interpretable.

Finally, the present study did not include any classroom observation to look out for treatment fidelity during the intervention period. It is noted, however, that the absence of classroom observation is to minimize any elemental intrusion into classrooms. Still, future studies may utilize the classroom observations to examine the consistency of autonomy-supportive teaching style.

In conclusion, results of this study herein suggest the important role of autonomy-supportive teachers in establishing the positive interpersonal climate to increase self-determination in schools. Despite the extensive SDT-based research, the present study expands upon previous classroom-based interventions and sheds light on the inclusion of MSLQ-based variables. The current findings also contribute to the understanding of autonomy-supportive teaching style and its effects on student motivational-cognitive learning. Besides the importance of teaching style, further research may look at other social factors such as classroom structure and culture in similar academic contexts.

References

Anderman, L. H. (2003). Academic and social perceptions as predictors of change in middle school students' sense of school belonging. *The Journal of Experimental Education, 72*(1), 5–22.

Assor, A., Kaplan, H., & Roth, G. (2002). Choice is good, but relevance is excellent: Autonomy-enhancing and suppressing teacher behaviours predicting students' engagement in schoolwork. *British Journal of Educational Psychology, 72*(2), 261–278.

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development, 78*(1), 246–263.

Britner, S. L., & Pajares, F. (2006). Sources of science self-efficacy beliefs of middle school students. *Journal of Research in Science Teaching, 43*(5), 485–499.

Brooks, C. F., & Young, S. L. (2011). Are choice-making opportunities needed in the classroom? Using self-determination theory to consider student motivation and learner empowerment. *International Journal of Teaching & Learning in Higher Education, 23*(1), 48–59.

Chatzisarantis, N. L. D., & Hagger, M. S. (2009). Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology & Health, 24*(1), 29–48.

De Naeghel, J., Van Keer, H., Vansteenkiste, M., & Rosseel, Y. (2012). The relation between elementary students' recreational and academic reading motivation, reading frequency, engagement, and comprehension: A self-determination theory perspective. *Journal of Educational Psychology, 104*(4), 1006–1021.

Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality, 62*(1), 118–142.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology, 49*(1), 14–23.

Den Brok, P., Brekelmans, M., & Wubbels, T. (2004). Interpersonal teacher behaviour and student outcomes. school effectiveness and school improvement. *An International Journal of Research, Policy & Practice, 15*(3–4), 407–442.

Diseth, Å., Danielsen, A. G., & Samdal, O. (2012). A path analysis of basic need support, self-efficacy, achievement goals, life satisfaction and academic achievement level among secondary school students. *Educational Psychology, 32*(3), 335–354.

Ee, J., Wang, C. K. J., Koh, C., Tan, O. S., & Liu, W. C. (2009). Goal orientations and metacognitive skills of normal technical and normal academic students on project work. *Asia Pacific Education Review, 10*(3), 337–344.

Furtak, E. M., & Kunter, M. (2012). Effects of autonomy-supportive teaching on student learning and motivation. *The Journal of Experimental Education, 80*(3), 284–316.

Gagne, M. (2003). Autonomy support and need satisfaction in the motivation and well-being of gymnasts. *Journal of Applied Sport Psychology, 15*(4), 372–390.

Jang, H., Kim, E. J., & Reeve, J. (2012). Longitudinal test of self-determination theory's motivation mediation model in a naturally occurring classroom context. *Journal of Educational Psychology, 104*(4), 1175–1188.

Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology, 102*(3), 588–600.

Joussemet, M., Koestner, R., Lekes, N., & Houlfort, N. (2004). Introducing uninteresting tasks to children: A comparison of the effects of rewards and autonomy support. *Journal of Personality, 72*(1), 139–166.

Katz, I., & Assor, A. (2007). When choice motivates and when it does not. *Educational Psychology Review, 19*(4), 429–442.

Legault, L., Green-Demers, L., & Pelletier, L. (2006). Why do high school students lack motivation in the classroom? Toward an understanding of academic amotivation and the role of social support. *Journal of Educational Psychology, 98*(3), 567–582.

Levesque, C., Zuehlke, A. N., Stanek, L. R., & Ryan, R. M. (2004). Autonomy and competence in German and American university students: A comparative study based on self-determination theory. *Journal of Educational Psychology, 96*(1), 68–84.

Liu, W. C., Wang, C. K. J., Tan, O. S., Koh, C., & Ee, J. (2009). A self-determination approach to understanding students' motivation in project work. *Learning & Individual Differences, 19*(1), 139–145.

McAuley, E., Duncan, T., & Tammen, V. V. (1989). Psychometric properties of the intrinsic motivation inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise & Sport, 60*(1), 48–58.

McHugh, R. M., Horner, C. G., Colditz, J. B., & Wallace, T. L. (2013). Bridges and barriers: Adolescent perceptions of student-teacher relationships. *Urban Education, 48*(1), 9–43.

Miserandino, M. (1996). Children who do well in school: Individual differences in perceived competence and autonomy in above-average children. *Journal of Educational Psychology, 88*(2), 203–214.

Otoshi, J., & Heffernan, N. (2011). An analysis of a hypothesized model of EFL students' motivation based on self-determination theory. *Asian EFL Journal, 13*(3), 66–86.

Pajares, F. (2005). Self-efficacy beliefs during adolescence: Implications for teachers and parents. In F. Pajares & T. Urdan (Eds.), *Adolescence & education: Self-efficacy beliefs of adolescents* (Vol. 5, pp. 339–366). Greenwich, CT: Information Age Publishing.

Paris, S. G., & Newman, R. S. (1990). Development aspects of self-regulated learning. *Educational Psychologist, 25*(1), 87–102.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation: Theory, research, and applications* (pp. 451–502). San Diego, CA: 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), 33–40.

Pintrich, P. R., Smith, D., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educational & Psychological Measurement, 53*(3), 801–813.

Reeve, J. (2009). Why teachers adopt a controlling motivating style toward students and how they can become more autonomy supportive. *Educational Psychologist, 44*(3), 159–175.

Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology, 105*(3), 579–595.

Reeve, J., Deci, E. L., & Ryan, R. M. (2004). Self-determination theory: A dialectical framework for understanding socio-cultural influences on student motivation. In M. McInerney & E. Shawn Van (Eds.), *Big theories revisited: Research on sociocultural influences on motivation and learning* (Vol. 4, pp. 31–60). Greenwich, CT: Information Age Publishing.

Reinboth, M., & Duda, J. L. (2006). Perceived motivational climate, need satisfaction and indices of well-being in team sports: A longitudinal perspective. *Psychology of Sport & Exercise, 7*(3), 269–286.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality & Social Psychology, 57*(5), 749–761.

Sierens, E., Vansteenkiste, M., Goossens, L., Soenens, B., & Dochy, F. (2009). The synergistic relationship of perceived autonomy support and structure in the prediction of self-regulated learning. *British Journal of Educational Psychology, 79*(1), 57–68.

Soenens, B., Sierens, E., Vansteenkiste, M., Dochy, F., & Goossens, L. (2012). Psychologically controlling teaching: Examining outcomes, antecedents, and mediators. *Journal of Educational Psychology, 104*(1), 108–120.

Soenens, B., Vansteenkiste, M., Lens, W., Luyckx, K., Goossens, L., Beyers, W., et al. (2007). Conceptualizing parental autonomy support: Adolescent perceptions of promotion of independence versus promotion of volitional functioning. *Developmental Psychology, 43*(3), 633–646.

Su, Y., & Reeve, J. (2011). A meta-analysis of the effectiveness of intervention programs designed to support autonomy. *Educational Psychology Review, 23*(1), 159–188.

Tessier, D., Sarrazin, P., & Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers' interpersonal style, students' motivation and psychological need satisfaction in sport-based physical education. *Contemporary Educational Psychology, 35*(4), 242–253.

Urdan, T., & Midgley, C. (2003). Changes in the perceived classroom goal structure and pattern of adaptive learning during early adolescence. *Contemporary Educational Psychology, 28*(4), 524–551.

Urdan, T., & Schoenfelder, E. (2006). Classroom effects on student motivation: Goal structures, social relationships, and competence beliefs. *Journal of School Psychology, 44*(5), 331–349.

Vallerand, R. J., Pelletier, L. G., & Koestner, R. (2008). Reflections on self-determination theory. *Canadian Psychology, 49*(3), 257–262.

Van Nuland, H. J. C., Dusseldorp, E., Martens, R. L., & Boekaerts, M. (2010). Exploring the motivation jungle: Predicting performance on a novel task by investigating constructs from different motivation perspectives in tandem. *International Journal of Psychology, 45*(4), 250–259.

Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of Educational Psychology, 101*(3), 671–688.

Wang, C. K. J., Liu, W. C., Koh, C., Tan, O. S., & Ee, J. (2011). A motivational analysis of project work in Singapore using self-determination theory. *The International Journal of Research & Review, 7*(1), 45–66.

Wigfield, A., Guthrie, J. T., Tonks, S., & Perencevich, K. C. (2004). Children's motivation for reading: Domain specificity and instructional influences. *The Journal of Educational Research, 97*(6), 299–309.

Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality & Social Psychology, 70*(4), 767–779.

Williams, G. C., McGregor, H. A., Zeldman, A., Freedman, Z. R., & Deci, E. L. (2004). Testing a self-determination theory process model for promoting glycemic control through diabetes self-management. *Health Psychology, 23*(1), 58–66.