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The Mediating Effect of Intrinsic Motivation to Learn on the Relationship between Student´s Autonomy Support and Vitality and Deep Learning

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Abstract. Self-determination theory has shown that autonomy support in the classroom is associated with an increase of students' intrinsic motivation. Moreover, intrinsic motivation is related with positive outcomes. This study examines the relationships between autonomy support, intrinsic motivation to learn and two motivational consequences, deep learning and vitality. Specifically, the hypotheses were that autonomy support predicts the two types of consequences, and that autonomy support directly and indirectly predicts the vitality and the deep learning through intrinsic motivation to learn. Participants were 276 undergraduate students. The mean age was 21.80 years (SD = 2.94). Structural equation modeling was used to test the relationships between variables and delta method was used to analyze the mediating effect of intrinsic motivation to learn. Results indicated that student perception of autonomy support had a positive effect on deep learning and vitality ($p < .001$). In addition, these associations were mediated by intrinsic motivation to learn. These findings suggest that teachers are key elements in generating of autonomy support environment to promote intrinsic motivation, deep learning, and vitality in classroom. Educational implications are discussed.

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Educating students to think critically, make connections between existing and new information, and processing information deeply has become a priority for today´s education (Yang, 2012). Learning is an active process that it is enhanced when students engage in learning activities with an autonomous motivation (Ryan & Deci, 2000a). In line with this theorizing, autonomous motivation can be determined by a teaching style that supports the student´s autonomy; this relationship (autonomy support and autonomous motivation) generates positive consequences for the student, because the teaching style allow students to satisfy their basic psychological needs (Núñez & León, 2015). When individuals have intrinsic motives, they tend to experience psychological well-being (Brown & Ryan, 2015). Vitality is one of the most important consequences for its relationship with well-being and both physical and psychological health (Ryan & Deci, 2008).

To promote deep learning and vitality adequately is necessary to explore the academic factors influencing them. Few studies have linked two types of outcomes as deep learning and vitality with intrinsic motivation to learn and autonomy support as determinants, neither have analyzed the mediating effect of intrinsic motivation to learn. Thus, the aim of this study is to analyze the mediating effect of intrinsic motivation to learn on the relationship between student´s autonomy support and two outcomes (i.e., deep learning, and vitality). In the following article, we review previous work on the interaction between autonomy support, intrinsic motivation, deep learning, and vitality.

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Deep-learning

Students use different strategies to learn new content; sometimes more superficial methods are used, such as repeating the material again and again until it is remembered; while others the material is processed and organized, making a deeper learning. Deep learning has significant benefits versus superficial learning when the student carries out a learning task: deep learning is related to academic performance (Salamonson et al., 2013), predicts GPA (Kusurkar, Croiset, Galindo-Garré, & Ten Cate, 2013), and allows for meaning-making (Doménech & Gómez, 2014). According to Biggs (1987), the characteristics of deep-learning strategy are the following: exhibit interest in the subject or task and derive enjoyment from the involvement; intend to search for meaning inherent in what is learned; connect the content to one's own experiences and real world; integrate parts into the whole and understand the relationship between different parts and attempt to infer theory from learned materials and

establish hypothesis. Knowing the antecedents of deep-learning strategy is essential because it determines that the processed information is encoded, and reaches the long-term memory. Thus, the information, and refinement of learning skills, may be incorporated into future learning or application.

Vitality

Well-being reflects a sense of vitality and inner wellness that characterizes the fully functioning organism (Ryan & Deci, 2001). Several indicators of well-being have been studied, such as self-esteem, life satisfaction, and vitality (León & Núñez, 2013). Ryan and Frederick (1997) defined vitality as a positive feeling of aliveness and as a state of high positive energy emanating from the self without fatigue or exhaustion. Vitality is a dynamic outcome that is influenced by both somatic (e.g., illness, symptoms of somatization) and psychological factors. On the psychological side, Ryan and Frederick (1997) argued that vitality should be maintained or enhanced under conditions where the behaviors are conducted in a self-determined way.

The links between autonomy support, vitality and deep learning

Self Determination Theory (SDT) is a theory of human motivation that explains the behavioral mechanisms that make people engage in certain behaviors and experience positive cognitive and affective consequences in different domains of life (Deci & Ryan, 2008). Cognitive Evaluation Theory (CET) is a mini-theory within the framework of SDT, which focuses on the determinants of intrinsic motivation (Deci & Ryan, 1985). This mini-theory is concerned with the conditions that facilitate versus diminish intrinsic motivation. CET posits that experiences that fulfill the feeling of autonomy enhance intrinsic motivation, whereas events that reduce this feeling lessen intrinsic motivation. Autonomy is an experience completely determined by the social environment. One of the most important and most studied social factors that enhance intrinsic motivation is autonomy support (Núñez & León, 2015).

Autonomy support refers to the instructional style that teachers use to identify, nurture, and build students' inner motivational resources (Reeve, Deci, & Ryan, 2004). It is an atmosphere where students are not pressured to behave in a specific way, and where they are, instead, encouraged to be themselves (Ryan & Deci, 2004). Autonomy support includes a variety of teacher's behaviors: providing meaningful rationale, acknowledging negative feelings, using non-controlling language, offering meaningful choices, and nurturing inner motivational resources.

A diversity of research has demonstrated that autonomy support in the classroom is related to greater well-being (Black & Deci, 2000) but also energetic resources and enthusiasm in fifth and sixth grade students (Mouratidis, Vansteenkiste, Sideridis, & Lens, 2011). Recently, Khalkahli and Golestaneh (2011) showed that the autonomy-supportive versus controlling motivational style promoted vitality in seventh grade students. The autonomous behaviors involve greater increase in vitality regarding more controlled activities (Deci & Ryan, 1985).

In accordance with the results of Grolnick and Ryan (1987) in a fifth grade students sample, autonomy support leads to an active processing, integration of learning, and greater conceptual understanding. Different studies have shown that the use of threats, deadlines, controlling evaluations, and tangible rewards undermine deep learning, whereas the use of behaviors that foster autonomy support promote persistence and learning (see Mouratidis et al., 2011, for an overview).

Mediating role of intrinsic motivation

We draw on SDT to test that students´ intrinsic motivation to learn will mediate the relationship between autonomy support and vitality, and deep learning. SDT holds that different types of motivation explain the human behavior: intrinsic motivation, extrinsic motivation, and amotivation. These types of motivation are placed on a self-determination continuum, ranging from self-determination to lack of control (Deci & Ryan, 1985). Intrinsic motivation reflects the highest degree of self-determination and autonomous motivation. The students engage voluntarily in the learning process, that is, the individual is origin of his or her actions. Intrinsic motivation promote high-quality learning and creativity (Ryan & Deci, 2000b).

SDT posits that the teacher motivational style could explain variance in student's motivation. Autonomy support in the classroom is associated with an increase of undergraduate students' intrinsic motivation to learn (Reeve & Jang, 2006). Vansteenkiste et al. (2012) noted that students (age range between 12 and 21 years) in the high autonomy support-clear expectations cluster reported the highest degree of autonomous motivation. In addition, Koka (2013) showed that school students, who perceived that their teacher emphasized teaching, took students' abilities into account and exhibited interest and concern for the students' welfare, experienced a higher level of autonomous motivation. Recently, De Naeghel et al. (2014) observed that teachers' autonomy support was related to intrinsic reading motivation in a sample of high school students.

There is strong evidence that intrinsic motivation to learn is associated with deep learning and less superficial information processing in college students (Vansteenskiste, Simons, Lens, Sheldon, & Deci, 2004). Essential elements of intrinsic motivation as challenge and curiosity have positive effects on secondary students' deep strategy (Chan, Wong, & Lo, 2012). Kusurkar, Croiset, Galindo-Garré, and Ten Cate (2013) concluded that the high intrinsic motivation and low controlled motivation cluster is related with deep study strategy in undergraduate students. Thus, the most positive outcomes are obtained when the task is framed in terms of an intrinsic motivation and is introduced in an autonomy-supportive way (Vansteenskiste et al., 2004).

The relationship between intrinsic motivation and vitality has been established by different studies. Sheldon, Ryan, and Reis (1996) found support for the association of intrinsic motivation and vitality in a 2-weeklong diary study of college students. Studies with college and undergraduate students suggests that participating in an activity intrinsically can help maintain or increase vitality (Nix, Ryan, Manly, & Deci, 1999). Recently, Khalkahli and Golestaneh (2011) concluded that seventh grade students that have intrinsic motives experience greater vitality.

Hypotheses

On the basis of the SDT, we propose the following specific research questions: a. Whether autonomy support is related to vitality, and students´ deep learning; b. Whether intrinsic motivation to learn mediates the associations between autonomy support and vitality, and between autonomy support and deep learning.

For the first specific research question, we hypothesize that autonomy support predicts two types of consequences, deep learning, and vitality. For the second specific research question, we hypothesize that autonomy support directly and indirectly predicts deep learning and vitality through intrinsic motivation to learn.

Method

Participants

A total of 276 undergraduate students (29 male, and 241 female) of second, third, and fourth year completed the questionnaires. They belonged to four degrees taught at the University of Las Palmas de Gran Canaria (i.e., early childhood education, primary education, social education, and social work). The mean age was 21.80 years (*SD* = 2.94). The sampling was by conglomerates where the unit of analysis was the classroom.

Measures

To examine reliability in study measures, we used McDonald´s Omega instead of Cronbach's alpha, because the latter requires that the factor loadings are not different for all items in the same factor (Yang & Green, 2010) and that the nature of the data is continuous. Moreover, McDonald´s Omega has shown evidence of better accuracy (Revelle & Zinbarg, 2009). Taking into consideration that we used Likert-type scales (participants´ responses are scaled ordinally), we followed Zumbo, Gadermann, and Zeisser (2007)'s recommendations and computed loadings and residuals needed to estimate McDonald´s Omega using the polychoric correlation matrix. We used Mplus 7.2 to estimate loadings and residuals, and Microsoft Excel to compute McDonald´s Omega. It should be noted that, similar to Cronbach´s alpha, McDonald´s Omega range is between 0 and 1, with higher values implying reliable measures. More information about the method used to estimate loadings can be found in the data analysis section.

Autonomy support

To assess student autonomy in the classroom, students responded to the Spanish short version of the Learning Climate Questionnaire (Núñez, León, Grijalvo, & Martín-Albo, 2012) on a 7-point scale (1 = *strongly disagree* to 7 = *strongly agree*). The five items were prefaced with "in class" in order to assess student autonomy in the classroom (e.g., "I feel free in my decisions"). This measure has been reliable in the present study (ω = .92).

Intrinsic motivation to learn

To assess students' intrinsic motivation to learn, participants rated four items from the intrinsic motivation toward knowledge subscale of the Spanish version of the Academic Motivational Scale (Núñez, Martín-Albo, & Navarro, 2005) on a 7-point scale (1 = *strongly disagree* to 7 = *strongly agree*). All items were prefaced by "Why do you go to high-school?" Sample items included "Because for me it is a pleasure and satisfaction to learn new things". These items have been reliable in the present study (ω = .92).

Vitality

To assess vitality, we used the Spanish version of the Subject Vitality Scale (Balaguer, Castillo, García-Merita, & Mars, 2005). It consists of seven items that were rated according to a Likert scale of seven points from 1 (*strongly disagree*) to 7 (*strongly agree*). The reliability in the present study was ω = .96.

Deep learning

Students' deep learning was assessed using the deep learning subscale of the Spanish version of the Assessment Experience Questionnaire (AEQ; Núñez & Reyes, 2014). This subscale includes 3 items (e.g., "I usually set out to understand thoroughly the meaning of what I am asked to read") rated according to a Likert scale of five points from 1 (*strongly disagree*) to 5 (*strongly agree*). Results have shown evidence of reliability (ω = .84).

Procedure

We contacted the Dean of the Faculty to request permission and explain the research details. We explained the students the research goals, and informed them that participation was voluntary and confidential, to avoid the possible effect of social desirability. At the same time, we requested their cooperation and asked them to complete the questionnaires as honestly as possible. One researcher was present during the administration of the instruments, and provided students with the necessary support to successfully complete the instruments.

Data analysis

Descriptive analyses were conducted, including Pearson´s correlations between major variables. We tested study hypotheses by using structural equation modeling. Because the observed variables or the scale items were ordered categorically, not following a normal distribution, we decided to use weighted least square mean and variance adjusted (WLSMV) as this estimation method does not require multivariate normality. Importantly, to avoid the underestimation caused by the violations of independency because students were grouped by classes, we estimated standard errors using a sandwich type estimator. To address our goal, first we fitted a baseline model to assess the direct effect of autonomy support on vitality and deep learning. Then we incorporated intrinsic motivation between the independent and the two dependent variable. To test for mediation, we estimated total, direct and indirect effects, with its 95% confidence interval using the delta method (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002), instead of the Baron and Kenny (1986), because the latter have low power to detect an effect (MacKinnon et al., 2002). With this method, if the direct effect (from autonomy support to deep learning or vitality) and indirect effects (multiplication of the effect from autonomy support to intrinsic motivation by the effect of intrinsic motivation to the dependent variable) are significant, we can establish mediation. Lastly, we used full information maximum likelihood method to estimate missing data. All of the calculations were done with Mplus 7.2.

Results

Preliminary analyses

Descriptive statistics (means and standard deviations), and Pearson´s correlation for all variables are displayed in Table 1.

Structural equation modeling

We tested two alternative models. First, we evaluated the hypothesized model, in which autonomy support acts as a determinant of intrinsic motivation to learn, which, in turn, predicts vitality and deep learning. Taking into account the direct effects of autonomy support on deep learning and vitality, the χ^2 test and the fit indexes were χ^2 (275, 87) = 189.33 ($p < .001$), CFI = .99, TLI = .99, and RMSEA = .07 [05, 08]. Autonomy support significantly predicted deep learning and vitality with standardized regressions of β = .33 [.28, .39] and β = .27 [.13, .42].

Taking into consideration the indirect effects of intrinsic motivation to learn between autonomy support on deep learning and vitality, the χ^2 test and the fit indexes for the hypothesized model (Figure 1) were χ^2 (275, 146) = 257.05 ($p = < .001$), CFI = .99, TLI = .99, and RMSEA = .05 [04, 06]. The effect of autonomy support on vitality was .27 [.13, .42], which can be divided in the direct effect: .20 [.07, .34] and the indirect effect via intrinsic motivation to learn: .07 [.03, .12], so the effect of autonomy support on vitality was mediated by intrinsic motivation to learn. With regard to the effect of autonomy support on deep learning, it was .33 [.28, .39], which can be divided in the direct effect: .27 [.18, .36] and the indirect effect via intrinsic motivation to learn: .06 [.01, .12], so the effect of autonomy support on deep learning was also mediated by intrinsic motivation to learn. The effect of autonomy support on intrinsic motivation to learn was .30 [.19, .41], the effect of the latter on vitality was .23 [.13, .34] and on deep learning was .21 [.09, .34]. The model explained 15% and 13% of the variance in vitality and deep learning, respectively. It should be noted that due to the high percentage of female

Table 1. *Mean, standard deviation and Pearson´s correlations*

Variable	*M*	*SD*	1	2	3
1. Autonomy support	3.84	1.18			
2. Intrinsic motivation	5.04	1.44	.29		
3. Deep learning	3.76	.74	.29	.26	
4. Vitality	5.09	1.27	.27	.26	.03

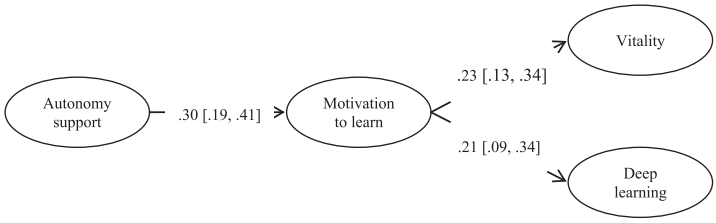

Figure 1. Model depicting mediational effect of intrinsic motivation to learn between autonomy support and vitality and deep learning. For clarity, the direct effects of autonomy support on the dependent variable is not represented, can be read in the results section.

students, we tested the models with only female students; differences came in the second or third decimal for fit indexes and for relationships between variables.

Second, we tested an alternative model in which autonomy support acts as a determinant of deep learning, which, in turn, predicts intrinsic motivation to learn which, in turn, predicts vitality (autonomy support → deep learning → intrinsic motivation to learn → vitality), freeing the path from autonomy support to vitality and to intrinsic motivation. The χ^2 test and the fit indexes for the alternative model were $\chi^2(275, 147) = 255.65$ ($p < .001$), CFI = .99, TLI = .99, and RMSEA = .05 [04, 06]. The effect of autonomy support on deep learning was .32 [.26, .38] and on intrinsic motivation to learn was .25 [.15, .36], and on vitality it was .18 [.05, .31]. The effect of deep learning on intrinsic motivation to learn was .17 [.03, .32], and of the latter to vitality was .23 [.12, 33]. To compare both models we performed a χ^2 difference test and examined differences in RMSEA and CFI, following Morin et al. (2011) recommendations; we can establish that models differ when there are differences of .015 for RMSEA and .01 for CFI. We observed that the χ^2 test (adjusting for the correction factor because of the WLSMV estimator) comparing both models was significant: $\Delta\chi^2(275, 1) = 4.593$ ($p = .03$); however no differences were observed for RMSEA and CFI, therefore we can conclude that the alternative model does not fit better than the hyphotesized.

Discussion

According to SDT, if the teaching style fulfill the basic students´autonomy it will positively influences on students´ intrinsic motivation to learn. Moreover, intrinsic motivation is a type of motivation that generates positive consequences on the student. Therefore, the aim is to analyze the mediating effect of intrinsic motivation to learn on the relationship between student´s autonomy support and two positive outcomes types, one related to the learning strategy (deep learning), and another relating to the student´s well-being (vitality).

As we predicted, teaching style has positive effects related to deep learning and student well-being. According to Hypothesis 1, students who report that teachers provide autonomy support in classroom, are more likely to learn in a deeper way, connecting new academic content with prior knowledge and to feel positive energy for academic tasks. This result is consistent with the SDT tenets and in line with the findings of Grolnick and Ryan (1987), because a teaching style that supports autonomy leads to an information active processing, and a comprehensive study of the concepts, and with recent studies that state that autonomy-supportive style promotes vitality and enthusiasm of students (Khalkahli & Golestaneh, 2011; Mouratidis et al., 2011). In addition, autonomy support in classroom has a similar influence on both consequences, deep learning and vitality; thus, autonomy support leads to benefits to the student relating to learning and well-being an equivalent way.

This study identifies the role that intrinsic motivation to learn play in mediating the relationship between autonomy support and two consequences, deep learning, and vitality. It is shown that student perceptions of the autonomy support in classroom directly and indirectly predict the level of deep learning and vitality through intrinsic motivation to learn. Consistent with the Hypothesis 2, an environment that supports student autonomy promotes an active learning strategy, and a state of high positive energy through its influence on intrinsic motivation to learn. Specifically, intrinsic motivation to learn is enhanced when the classroom environment provides meaningful rationale, acknowledging negative feelings, using non-controlling language, offering meaningful choices, and nurturing inner motivational resources. This result is in line with the postulates of CET and with different researches which relate the increases of intrinsic motivation with autonomy support in classroom (Reeve & Jang, 2006; Vansteenkiste et al., 2012). In this sense, practical behaviors or suggestions that teachers could use to improve the autonomy in classroom may be the following: verbal explanations that allow students to understand why self-regulation of the activity would be useful; tension-alleviating acknowledgment that teacher's demand clashes with their

personal preferences and that their feelings of conflict are reasonable; minimize the use of terms such as ''should,'' ''must,'' and ''have to,'' carrying a sense of choice and flexibility in the phrasing, provide information about options; and reinforce the interest, enjoyment, or curiosity while engaging in an activity (Núñez & León, 2015). The teacher should allow students to choose group members, evaluation procedures, due dates, what materials to use in their schoolwork, or how to display their work. The students should find multiple solutions to problems, and debate ideas freely.

Moreover, there are some practical implications derived from this study results. Exposure to autonomy support context in the classroom might translates in an enhance of comprehensive learning and vitality both directly and through the intrinsic motivation to learn. Therefore, teachers have a critical role to play in creating a positive academic environment which can in turn help them to promote interest and enjoyment of the academic tasks. In this sense, research has identified several factors that influence autonomy-supportive teaching behaviors, such as teachers' self-determined motivation, personal characteristics, perception of the satisfaction of their basic psychological needs, and their own performance appraisal, cultural norms, and time constraints. However, future research should examine which factors have the greatest influence on teachers in order to develop evidence based interventions; besides, the majority of autonomy support intervention programs have integrated the elements that define autonomy support in the classroom, but further research is needed to determine the essential elements of optimal autonomy support. Thus, qualitative analyses may be necessary to include new conceptualizations of autonomy support in the classroom and modify the existing ones (Núñez & León, 2015). Furthermore, the increase of intrinsic motivation facilitates the adoption of deep learning strategies which are considered adaptative in learning. Autonomy support environment and intrinsic motivation are necessary elements for adaptative motivational outcomes (Sheldon et al., 1996). This study reports on the significant influence of the environment and motivation on deep learning and vitality; therefore key points of intervention are highlighted.

However, this study presents some limitations. Firstly, an important limitation is that the use of cross-sectional data do not allow causal inferences. Secondly, the model tested used a sample of university students, and it would be relevant to perform an analysis of invariance as a function of variables that may affect the results, such as gender. Third, regarding external validity, the participants of this study were university students; therefore, we cannot generalize the results to the general population. Although the results of the scientific literature reviewed, suggest that the relationships between the studied variables (i.e. autonomy support, intrinsic motivation, deep learning, and vitality) are consistent across age groups and academic levels, it would be interesting to test the hypothesized relationships at different academic levels. Fourth, future research should test the hypothesized model in a longitudinal study. Fifth, considering fit indexes of the alternative model, the role of deep learning should be further explored; future studies should analyze and compare the influence of deep learning as antecedent and as consequence of intrinsic motivation. Lastly, as this study was carried out at a contextual level, it would be interesting to verify the mediating role of perceived competence at other levels of generality (i.e. global and situational levels).

In conclusion, teachers can promote student learning motivation, deep learning, and vitality by creating a supportive academic environment that provides chances for student to feel autonomous. Intrinsic motivation to learn should be considered a mediator between autonomy support environment in classroom and two motivational outcomes related with the adaptive learning (deep learning) and well-being (vitality) when planning an intervention to increase them.

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