

Teachers' epistemological beliefs as an antecedent of autonomy-supportive teaching

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Abstract A large body of research has been devoted to the outcomes of autonomy-supportive teaching (AST). However, research on its antecedents is scarce. The present study explored teachers' personal epistemology as a possible predictor of students' perceptions of AST. We administered surveys to 622 students in 23 seventh- and eighth-grade classrooms regarding the extent to which their teachers tried to take the students' perspective and to provide rationale—major aspects of autonomy support. At the same time, their teachers' personal epistemologies were assessed. Hierarchical linear model analysis revealed that students of teachers scored with more objectivist (absolutist) personal epistemologies reported that their teachers were less likely to be autonomy supportive. AST, in turn, predicted students' optimal internalization of pro-social behavior. Further exploration of a range of teachers' personal characteristics, then, would appear to be an important and productive approach to understanding the variability of teachers' engagement in autonomy supportive practices.

Keywords Personal epistemology · Autonomy support · Teaching · Internalization

Introduction

In the last two decades, research has demonstrated the important role of autonomy-supportive teaching (AST) in relation to students' autonomous motivation, quality of

school engagement, and well-being (Assor et al. 2002; Grolnick et al. 1991; Reeve et al. 2004; Roth et al. 2009a, b; Sierens et al. 2009; Soenens and Vansteenkiste 2005; Williams and Deci 1996). However, despite the rich research on consequences of AST, research on its antecedents is quite scarce.

AST has been pinpointed as especially important because it promotes students' autonomous internalization and autonomous motivation, which according to self-determination theory (SDT; Ryan and Deci 2000) refers to acting with a sense of volition and choice and stands in contrast to controlled internalization, which refers to performing a behavior out of a sense of pressure or compulsion (Assor et al. 2004; Roth et al. 2009a). Thus, the present research focuses on teachers personal epistemology, which has been conceptualized as an individual's perspective on the characteristics of knowledge and the nature of knowing (Hofer and Pintrich 1997), as a possible predictor of AST and students internalization of prosocial behavior.

Self-determination theory of internalization

Deci and Ryan (1985, 2000) differentiated the concept of internalization by suggesting that different types of internalization can be characterized in terms of a relative autonomy continuum based on the degree to which a behavioral regulation has been internalized. SDT specifies four types of behavioral regulation that will be evident when a behavior and its accompanying value have been internalized to differing degrees. Before any internalization of a specific behavior has occurred, the behavior is said to be enacted through *external* regulation. To the extent that the behavior is displayed, it is because the child complies with specific demands and contingencies. Behavior so regulated is said to be controlled by those contingencies

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rather than enacted volitionally or autonomously (Ryan and Connell 1989).

The first and least effective type of internalization is *introjection*, which results in introjected regulation of the relevant behaviors. *Introjection* involves the child rigidly taking in the behavioral regulation but not accepting its value as his or her own. With introjected regulation, the behavior is said to be controlled by the desire for feelings of generalized social approval and self-worth, which are experienced as dependent on specific behaviors or attributes.

Within SDT, a fuller type of internalization is said to result from *identifying* with the importance of the behavior vis-a-vis one's personal values and goals. The resulting regulation, which is referred to as *identified* regulation, is considered relatively autonomous because the person has accepted the value of the activity as his or her own.

The fullest internalization, resulting in the most effective form of internalized regulation, is referred to as *integration* and results from reciprocally assimilating the identification with other aspects of one's self. Underlying subsequent behavioral enactment will be integrated regulation. Both identified and integrated regulation is considered relatively autonomous, and when so regulated people experience a sense of choice. In addition, SDT states that some behaviors are intrinsically motivating so their enactment does not depend on internalization but, rather, stems from intrinsic interests.

To summarize, the SDT model of behavioral regulation proposes that external and introjected regulations are controlled, whereas identified and integrated regulations (as well as intrinsic motivation) are autonomous or self-determined. Considerable research indicates that in contrast to controlled internalization, autonomous internalization tend to be associated with more positive outcomes such as greater creativity, flexibility of thought, effective problem solving, and psychological health (Assor et al. 2002; Roth et al. 2009b; Vansteenkiste et al. 2005). In contrast, controlled motivations tend to be associated with negative psychological consequences, including poorer performance on heuristic tasks, more maladaptive behaviors, and lower psychological well-being (Assor et al. 2002; Jang 2008; Reeve 2006; Roth et al. 2006, 2009a).

Antecedents of autonomy supportive teaching

Self-determination theory distinguishes between controlling versus autonomy-supportive socializing contexts that lead to controlled internalization versus integration. Autonomy support is defined as the degree to which socializing agents relate to people (e.g., children, students, employees, and partners) from those people's own perspectives; act in ways that encourage choice, self-initiation,

and participation in decision making; provide meaningful rationales and relevance; and refrain from using language or other behaviors that are likely to be experienced as pressure toward particular behaviors. Supporting autonomy in these ways has been found to enhance autonomous motivation, and to result in effective performance and psychological well-being (Assor et al. 2002; Grolnick et al. 1997; Reeve 2006).

Only a few studies have explored antecedents of autonomy support. The first to explore this question were Deci et al. (1982). They found that impressing upon teachers that they are responsible for their students' performance leads them to be more controlling than teachers who were told that there were no performance standards for their students' learning. In a more recent study Pelletier et al. (2002) showed that teachers who perceive more pressure from above (e.g., to comply with a curriculum or with performance standards) and more pressure from below (i.e., perceiving their students as non-self-determined) are less self-determined in their teaching. Finally, Roth et al. (2007) explored a specific characteristic of teachers, namely their type of motivation for teaching, as a possible predictor of their autonomy supportive teaching. It was found that teachers' autonomous motivation predicts students' perceptions of AST, which, in turn, predicts students' autonomous motivation toward learning. This study supports Reeve's (1998) finding that pre-service teachers' *autonomy orientation* (i.e., as measured by causality orientation—acting out of interest and valuing one's actions) is related to their intention to nurture their students' autonomy.

In a recent series of studies, Grolnick and her colleagues (Grolnick 2003; Grolnick et al. 2007) examined antecedents of autonomy-supportive parenting and focused on environmental pressures that may undermine parents' autonomy support. Grolnick et al. (2007) found that mothers who scored high on socially contingent self-worth were more prone to environmental pressures that undermine autonomy supportive parenting, than mothers who were low on contingent self-worth. In line with this research on antecedents of autonomy supportive parenting, Moorman and Pomerantz (2010) followed Dweck's (1999) conceptualization of entity and incremental naive theories on intelligence. They found that mothers who were experimentally induced with an entity mindset, in which children's ability is seen as unchangeable, displayed heightened unconstructive involvement (i.e., performance-oriented teaching, control, and negative affect) in their children's learning in comparison to mothers with an induced incremental mindset, in which children's ability is seen as changeable.

Thus, recent research has shown that personal characteristic of parents and teachers predict the extent to which

they use autonomy supportive practices toward children. In accordance with this new line of research, the present study explores a specific personal characteristic of teachers as a possible predictor of AST. Specifically, we hypothesized that teachers' personal epistemology may predict students' perception of AST, which in turn may be linked to students' autonomous internalization of prosocial behavior. We chose to focus on this domain of behavior because the domain is highly relevant to the school context.

Personal epistemology

People have different conceptions of the nature of knowledge and the nature of knowing (Hofer and Pintrich 1997). Most people do not have the well-developed, probing, scholarly epistemologies of philosophers; yet, they maintain common-sense theories about similar issues such as what counts as sufficient justification, where knowledge comes from, and whether there are objective means by which to evaluate knowledge claims. In order to contrast everyday theories of knowledge with those held by philosophers of knowledge, different psychological and educational research approaches to people's conceptions of knowledge and knowing have been commonly grouped under the term "personal epistemology" (Hofer and Pintrich 2002). People may not be fully aware of the personal epistemological assumptions that they hold, but their common-sense theories come into play when engaged in justifying or evaluating knowledge claims, thus appearing as "theories-in-action" (Kuhn and Weinstock 2002). Pertinent to the current study, as teachers' interactions with students revolve around knowledge and knowing, their personal epistemologies should be implicit in their formal and informal teaching behaviors.

Hofer and her colleagues (2000; Hofer and Pintrich, 1997) have proposed four personal epistemological dimensions: certainty, simplicity, source, and justification of knowledge. People's views of each dimension of knowledge and knowing, lie along a spectrum from objectivist to relativist. Those with objectivist theories of knowledge—what Hofer and others (e.g., Kuhn and Weinstock 2002) term as *absolutist*—would maintain that the source of knowledge is external. The source of knowledge is the observable world or knowledge authorities (textbooks, teachers, etc.). Such objectively obtained knowledge would necessarily be certain. Those conceiving of knowledge as absolute and objective would also think that knowledge is simple, allowing single correct answers and self-evident truths. In contrast, those viewing knowledge as relative would hold that subjective construction is the source of knowledge. Inasmuch as there is no access to objective truths from this point of view, knowledge is necessarily uncertain. Those with relativist personal

epistemologies would accept that knowledge is complex and changing, and it permits multiple possibly legitimate, justifiable knowledge claims.

The field of personal epistemology has its roots in college student development (Perry 1970). Following from this, most research on personal epistemology has concerned the function of personal epistemologies in educational contexts (Bendixen and Feucht 2010; Hofer 2001), with a particular focus on students. Researchers have found that less absolutist epistemological beliefs (more relativistic) predict self-regulated learning (Bråten and Strømsø 2005), achievement goals orientation (Bråten and Strømsø 2004; Paulsen and Feldman 1999; Ricco and Rodriguez 2006; Ricco et al. 2010), motivation (Paulsen and Feldman 1999), academic achievement (Cano 2005; Ricco et al. 2010), learning processes (Cano 2005; Nussbaum et al. 2008), the understanding of texts (Bråten and Strømsø 2006, 2010), and students' online search methods (Barzilai and Zohar 2012; Bråten et al. 2006; Hofer 2004; Mason and Boldrin 2008; Mason et al. 2011). Those with less absolutist personal epistemologies have also been shown to better construct and evaluate arguments in middle school (Mason and Scirica 2006), high school (Weinstock et al. 2006), and post-secondary educational contexts (Nussbaum et al. 2008; Ricco 2007). Even those who tend to focus on the relationship between personal epistemology and the reasoning skills of adults in non-educational contexts have considered educational experience to be an important potential factor in its development (Kuhn 1991; Weinstock and Cronin 2003).

Teachers' epistemological beliefs

Given the central role that teachers play in education, a growing subset of research on personal epistemology focuses on teachers' epistemological beliefs. Classroom teachers' main official task is to facilitate their students' acquisition of and inquiries into knowledge within the learning environment. Thus, teachers' theories of knowledge and knowing processes may well impact their interactions with students and their teaching behaviors, thereby affecting students' processing, regulations and attitudes in class. However, most research on teachers' epistemologies has focused on teachers or student teachers as learners (e.g., Bråten and Strømsø 2005, 2006; Brownlee 2001; Brownlee et al. 2009; Tanase and Wang 2010) or specifically on uncovering teachers' epistemological beliefs, particularly as related to teaching (Aypay 2010; Berthelsen et al. 2002; Brownlee et al. 2009; Chai et al. 2006; Chan and Elliott 2004; Cheng et al. 2009; Sinatra and Kardash 2004), without looking directly at how those teacher epistemologies might influence actual teaching behaviors. This surprising paucity in the literature occurs despite the

strong assumption that teachers' epistemological beliefs should influence their teaching (Hofer 2001; Feucht and Bendixen 2010).

The few studies that did focus on the assumed relationship between teachers' epistemologies and specific types of pedagogy have shown mixed results. Some indicated that teachers' professed beliefs bear little relationship to their teaching (Kang 2008; Olafson and Schraw 2006), whereas others suggested a relationship (Yang et al. 2008) at least in how they conceive if not in how they practice instruction. For instance, those expressing relativist epistemological beliefs that value individual construction of knowledge may still employ traditional teaching practices that do not focus on student construction of knowledge. It is difficult to interpret the lack of strong evidence for a relationship between teachers' epistemological beliefs and formal instructional practices. Institutional demands might well constrain teachers' practices in a way that obscures the manifestation of their epistemological beliefs in classroom pedagogy (White 2000).

One study that indirectly examined how teachers' epistemologies influence their students' thinking has particular relevance for the current study. Using case studies of two teachers with different morality-related epistemologies and their young elementary school students, Brownlee et al. (2012) found that the teacher with the more sophisticated (relativist) epistemology had a higher percentage of students with more sophisticated epistemologies compared to students of the teacher with a less sophisticated (absolutist) epistemology. The study focused specifically on teachers' views of their moral pedagogy and their epistemology of moral education, and on students' learning of moral values and stated basis for moral decisions. The apparent reflection of the teachers' epistemologies and teaching regarding moral values in the students' moral values holds particular relevance for the current study, which focuses on the teachers' autonomy supportive practices toward students' identified regulation (autonomous internalization) of pro-social behaviors and values. Thus, the current study, taking a quantitative approach, directly examined the relationship between teachers' epistemologies and how students' perceive teachers' teaching behaviors as supporting their autonomous regulation in the realm of prosocial behavior.

A teacher's epistemological beliefs may influence other aspects of the teacher's teaching behaviors, interactions with students, and perceptions of students—beyond formal instruction. Interestingly, another recent qualitative study found that teachers with a more sophisticated personal epistemology viewed students as competent, active learners who construct their own meanings and need to be respected as learners (Brownlee et al. 2011). Such an epistemological view may help open the door for teachers' autonomy

support, which attempts to respectfully take the students' perspective and to provide students with choices and opportunities to express their opinions. On the other hand, the research found that teachers with a less sophisticated personal epistemology believed that students learn mainly from modeling and imitation.

The current study

The main assumption of the present study was that AST may be predicted by teachers' relativistic epistemological orientation. A teacher who holds sophisticated, relativist epistemological understandings—asserting that multiple, possibly legitimate perspectives exist and that knowing is a process of choosing the apparently best explanation among alternatives—might be inclined to use autonomy-supportive practices. These would involve taking the students' perspective, encouraging students to express criticism and make choices, and providing students with rationales for teachers' expectations, rather than expecting that everyone should hold the same perspective as the teacher. In contrast, teachers with more objectivist, authority-centered epistemological beliefs might be more inclined to expect students to work toward single, right answers, perspectives, and decisions. Students are likely to experience this as pressure toward particular behaviors, and, thus, as unsupportive of their autonomy.

We thus hypothesized that students will rate teachers who hold less objectivist epistemological beliefs as more autonomy supporting than teachers who hold more objectivist (absolutist) epistemological beliefs. We further hypothesized that teachers' relativist epistemological beliefs and students' perceptions of AST would be related to students' autonomous internalization (identified regulation) of prosocial behavior and that the students' perceptions of AST would mediate the relationship between teachers' epistemological beliefs and students' autonomous regulation.

In past research, AST and students' internalization have been measured in relation to specific domains like academics, sports, emotion regulation, and prosocial behavior (see for example: Assor et al. 2004; Roth et al. 2009a, b; Ryan and Connell 1989). In the present study, we measured students' perceptions of AST and students' identified regulation (autonomous internalization) in relation to prosocial behavior.

Method

Participants and procedures

The sample consisted of 622 Israeli junior high school students (51 % females) in Grades 7 and 8 from 23 classes

and their 23 homeroom teachers from four schools serving students from lower-middle- to middle-class socioeconomic backgrounds. The students Mean age was 13.3 years ($SD = .47$) and the teachers Mean age was 41.3 ($SD = 7.4$). The 23 homeroom teachers knew the students for at least 7 months and were teaching in their classes about 8 h per week. Thus, the students and the teachers knew each other quite well.

Adolescents reported their perceptions of their teachers' autonomy-supportive behaviors and their own level of internalization in relation to being considerate and sensitive toward classmates. Research assistants with special permission to work with students administered the questionnaires in the classrooms while teachers were not present. Homeroom teachers reported on their epistemological beliefs at the end of a school staff meeting led by a trained research assistant. Parental consent was obtained according to the Israeli Ministry of Education guidelines.

Instruments

Teachers' epistemological beliefs

Hofer's (2000) epistemological beliefs questionnaire asks respondents to consider a specific academic discipline while rating their level of agreement with statements like "In this subject, most work has only one right answer" or "If you read something in a textbook for this subject, you can be sure it's true" on a 5-point Likert-type scale ranging from 1 (*Strongly disagree*) to 5 (*strongly agree*). We instructed our sample of teachers to consider the discipline of history because we thought that teachers may tend to be less absolutist in this domain (in comparison to moral judgment, mathematics, etc.; see Kuhn et al. 2000; Tabak et al. 2010). For example, teachers' expression of absolutism in mathematics may be expected inasmuch as the domain consists of well-structured problems, relies on axioms, and seeks single correct answers. However, history involves ill-structured problems based largely on interpretations of varied subjective narratives; therefore, teachers' absolutist views in history may indicate a broader personal tendency toward absolutism that may reflect a general characteristic of the teachers.

Hofer's instrument theoretically tests for four dimensions of epistemology: certainty, source, simplicity, and justification of knowledge. However, due to the small number of teachers, we could not perform an adequate factor analysis. Thus, we followed others (e.g., Weinstock and Zviling-Beiser 2009) and used the instrument to provide a general picture of epistemological beliefs, where higher mean scores indicated more objectivist (absolutist) beliefs. Two items were eliminated from the original scale because they reduced reliability of the scale's Hebrew

version (The questionnaire was translated into Hebrew and back-translated into English). Internal reliability among the 25 items that we used was adequate: Cronbach alpha = .78. Items for Example are: "In this subject, most work has only one right answer," and "If you read something in a textbook for this subject, you can be sure it's true".

AST

The 14-item scale was developed by Roth et al. (2011). This scale was adapted from previous scales (Assor et al. 2002; Williams and Deci 1996) but was modified to measure students' perceptions of their homeroom teacher's autonomy support specifically in relation to the value of being considerate and helpful toward classmates. The scale included nine items for teachers' perspective taking (e.g., "The teacher makes sure to listen to both sides when intervening in a quarrel between kids") and five items for teachers' provision of rationale (e.g., "The teacher explains to us why it is important to be considerate to one another"). The students responded on a 5-point Likert-type scale ranging from 1 (*not true at all*) to 5 (*very true*). Factor analysis with varimax rotation was conducted on all 14 items, and one factor was extracted, accounting for 56 % of the variance. Thus, the factor analysis indicates that the two sets of items (for provision of rationale and for taking the child's perspective) do not constitute distinctive sub-scales. Cronbach alpha was .91.

Students' identified regulation

This 8-item scale measuring identified regulation was based on Ryan and Connell's (1989) approach for measuring controlled and autonomous internalization of prosocial behaviours. Ryan and Connell (1989) differentiate between internalization levels by asking students to indicate the reasons for their prosocial actions. Controlled reasons refer to external authority, fear of punishment, or rule compliance, whereas autonomous reasons refer to one's own values or goals. Although autonomous regulation includes two other subtypes (integrated and intrinsic), in the current study we focused only on identified regulation because intrinsic motivation for prosocial behavior—helping because it is interesting or enjoyable (Ryan and Connell 1989)—does not seem applicable, and because integrated regulation is difficult to measure with self-reports (Roth et al. 2006).

Participants rated their reasons for being considerate and helpful toward classmates (e.g., "because being considerate toward others is an important value for me"; "because I think it's important to give help when it's needed") on a 5-point Likert-type scale, ranging from 1 (*not true at all*) to 5 (*very true*). Cronbach alpha was .89.

Data analysis

In this study our major interest was to explore whether teachers with less absolutist epistemological beliefs have classrooms where students perceive them as more autonomy supportive and who express more autonomous regulation. Thus, we focused on between-class effects of teacher-reported epistemological beliefs on class reports concerning AST and autonomous regulation of prosocial behavior. Therefore, we conducted hierarchical linear model (HLM) analysis (Raudenbush and Bryk 2002), which allowed for the lack of independence among individuals in classrooms. We first present descriptive statistics, including correlations among the study variables separately for the student’s level and the class’s level¹, and then present the HLM results.

Results

Table 1 describes scores’ distribution for teachers’ personal epistemologies and for students’ reports of their regulation of prosocial behavior and of their teachers’ tendency to take students’ perspectives (AST). Higher scores in personal epistemology represented higher agreement with objectivist belief statements; therefore, we expected negative correlations between this score and the two other measures of students’ identified regulation and teachers’ AST. Aggregated classroom scores showed that each teacher’s personal epistemology correlated negatively with: (a) the degree to which students in the class perceived their teacher as taking the students’ perspectives and (b) the students’ degree of identified regulation of prosocial behaviors. This means that in classrooms where the teacher revealed a more objectivist (absolutist) personal epistemology the students rated the teacher as lower in taking students’ perspectives and rated themselves as lower in identified regulation, compared to classrooms where the teachers’ epistemology was more relativist. Furthermore, in line with our prediction and past research, AST was positively related to students’ identified regulation at both levels of analyses: between class and within class.

To test whether teachers’ personal epistemology and students’ reports of teachers’ autonomy support could account for students’ identified regulation, we computed a fully unconditional HLM analysis, analogous to an analysis of variance (ANOVA), with the students’ identified internalization as the dependent variable, and with classroom as

¹ Although there are three levels in our data we ignored the school level given the small number of schools. Means comparisons among schools on teachers’ epistemology and AST found no significant differences.

Table 1 Descriptive statistics and between-class correlations among the study variables

	M	SD	1	2	3
1 Teacher’s epistemology	2.56	.76	–		
2 AST (students’ perspective)	3.64 (3.60)	.32 (.90)	–.43*	–	
3 Students’ identified reg.	3.06 (3.07)	.29 (1.07)	–.39*	.53**	– (.41**)

The values in parenthesis are the descriptive statistics in the students’ (within- class) level

The range of scores was 1–5

* $p < .05$; ** $p < .01$

the grouping variable. This analysis enabled computation of the interclass correlations, which allowed an estimation of the within-class homogeneity of aggregated group-level constructs. Values of 5 % or above can be regarded as support for a variable’s adequate group level properties, warranting aggregation (e.g., Gavin and Hofmann 2002). Results indicated interclass correlations of 6 % in the present analysis.

Krull and MacKinnon (1999, 2001) described procedures for testing multilevel mediation models in which some variables are measured at the group level (only between-group variation) and some variables are measured at the individual level (both between- and within-group variation). In our case, teachers’ personal epistemology was a group-level variable (with between-group variation only), whereas students’ perceptions of AST was an individual-level variable (with both between- and within-group variation). The steps for testing a multilevel mediation model are similar to those used to test a traditional mediation model, as described by Baron and Kenny (1986).

Based on Krull and MacKinnon (1999, 2001), we first tested whether teachers’ personal epistemology predicted identified regulation of prosocial helping at the class level. The equations below represent the individual- and class-level models tested. For the sake of brevity, in addition to AST we used the following variable acronyms in the equations: teachers’ personal epistemology (TPE) and students’ identified regulation (IR).

$$\text{Level 1 equation (individual) : } \gamma_{ij}(\text{IR}) = \beta_{0j} + r_{ij} \quad (1a)$$

$$\text{Level 2 equation (class) : } \beta_{0j} = \gamma_{00} + \gamma_c(\text{TPE}) + \alpha_{0j} \quad (1b)$$

Results yielded a significant effect ($\gamma_c = -.19$, $t(20) = 2.01$, $p < .06$). Thus, although the association is only marginally significant in a two-tailed test, it is in the hypothesized direction. As expected, higher teacher scores

on objectivist epistemology predicted lower student reports of identified regulation (It is important to note that in a one-tailed test this association is significant and given the directional hypothesis it seems a valuable result).

The next step was to test whether teachers' personal epistemology predicted students' perceptions of AST at the class level. Using the procedure proposed by Krull and MacKinnon (2001), the following equations were calculated:

$$\text{Level 1 equation (individual)} : \gamma_{ij}(\text{AST}) = \beta_{0j} + r_{ij} \quad (2a)$$

$$\text{Level 2 equation (class)} : \beta_{0j} = \gamma_{00} + \gamma_a(\text{TPE}) + u_{0j} \quad (2b)$$

Results yielded a significant γ_a coefficient, suggesting that students whose teachers describe themselves as more objectivist perceived those teachers as less autonomy supportive ($\gamma_a = -.18$, $t(20) = 2.1$, $p < .05$).

The final stage was to test whether students' perceptions of AST would mediate the relations found between teachers' epistemological beliefs and students' identified regulation. If so, then: (1) The mediator (AST) would predict the dependent variable even when we controlled for the effects of teachers' personal epistemology. (2) The direct path between teachers' personal epistemology and the dependent variable would become non-significant when we controlled for the mediator of AST (γ_c). In line with the Krull and MacKinnon (2001) procedure, the following equations were used:

$$\begin{aligned} \text{Level 1 equation (individual)} : \gamma_{ij}(\text{IR}) \\ = \beta_{0j} + \beta_b(\text{AST}) + r_{ij} \end{aligned} \quad (3a)$$

$$\text{Level 2 equation (class)} : \beta_{0j} = \gamma_{00} + \gamma_c(\text{TPE}) + u_{0j} \quad (3b)$$

Analyses yielded a significant γ_b parameter, suggesting that students' perception of their teachers as autonomy supportive predicted students' identified regulation at the class level ($\gamma_b = .39$, $t(587) = 2.61$, $p < .01$) when we controlled for the teachers' epistemology. In addition, these analyses estimated the γ_c coefficient, which, as predicted, became non-significant when we controlled for the mediator of AST ($\gamma_c = -.07$, $t(587) = 1.28$, *ns*). It appears, then, that the analyses supported the mediation hypothesis.

Discussion

The main goal of the present study was to examine whether teachers' personal epistemology would predict their autonomy support during teaching. Results corroborated this hypothesis and further revealed that AST mediated the

link between teachers' epistemology and students' autonomous motivation. Teachers' more relativist epistemological beliefs, which assert that multiple legitimate perspectives on knowledge may exist, appear to better afford teachers the ability to understand students' perspectives and to provide rationale for their expectations. In turn, AST predicts students' internalization. These results replicate past research, providing further evidence of the documented relationship between AST and students' autonomous internalization and motivation (Deci and Ryan 2008), while also extending it to explore the antecedents of AST, about which research is rather scarce.

Given the positive outcomes of AST for students, the importance of studying its antecedents cannot be overemphasized. While past research on this topic mainly involved environmental pressures, the present research focused on specific personal beliefs held by teachers. The current findings suggest that it would be worthwhile to test the relationships between personal epistemology and other autonomy-supporting behaviors. For instance, the provision of choices to students might be characteristic of teachers who believe that there are no single, objective answers, and, in particular, that a teacher is not an absolute, objective authority who should preclude the choices of students. Teachers who encourage criticism might also believe that knowledge claims are open to criticism and need to be justified in the face of possible alternative viewpoints. With each of these behaviors, the teacher's willingness to cede authority and allow the students to think autonomously would appear to require that a teacher believes that knowledge is neither black-and-white nor determined by objective authorities.

Another apparently valuable avenue of research would be to explore whether teachers' personal epistemologies may moderate the negative relations between environmental pressures and AST. Inasmuch as past research found that external pressures like high-stake testing, deadlines, complying with a rigid curriculum, and comparative evaluation of teachers (and parents) increase teachers' use of controlling teaching practices and undermine AST and intrinsic motivation (Deci et al. 1982; Grolnick et al. 2007; Pelletier et al. 2002; Ryan and Sapp 2005), it would be important to study factors that may alleviate the effects of these pressures. Thus, teachers with a more relativist epistemology, who believe that multiple perspectives on knowledge may exist and that different perspectives should be considered, might be more resilient to the effects of those environmental pressures and expectations, which represent a single definition of "worthwhile" teaching and learning without accounting for other perspectives.

The findings are consistent with, and provide a stronger basis for, the conclusions of Brownlee et al. (2012), who showed that in classroom where teaching reflects

epistemological sophistication, the students report a greater sense of autonomous decision making, at least in the realm of morality. As neither the Brownlee et al. study nor the current study are causal studies, we cannot conclude that a teacher's personal epistemology is responsible for his or her support of autonomy. However, the findings suggest intriguing follow-up experimental studies that are particularly relevant to teacher education. One would be to employ a more differentiated personal epistemology construct that distinguishes between qualitatively different types of relativism (see Hofer and Pintrich 1997; King and Kitchener 1994; Kuhn et al. 2000; Weinstock and Cronin 2003). Using this construct, radically subjective relativism, commonly called "multiplism" (Kuhn et al. 2000), refers to the belief that there is no way to adjudicate multiple perspectives on knowledge and decide if one might be better justified than others. Like multiplism, the "evaluativism" epistemological perspective also rejects objectivist certainty but stands in contrast with the multiplist belief that all knowledge claims are equal. Evaluativists hold that because there is no access to objective, universal truths, justification is possible and even necessary, and knowledge claims can be legitimately evaluated and criticized.

Future research using this differentiated relativist epistemology construct may demonstrate that teachers who hold either of these relativist epistemologies would recognize the multiplicity of perspectives and, thus, be more likely to try to take their students' perspectives. However, perhaps evaluativists would be more likely than multiplists to engage in other AST behaviors such as the provision of rationale, as they believe in the necessity of justification, or the encouragement of criticism, as they believe that claims are open to critical evaluation. Perhaps even the quality of perspective-taking would differ because multiplists may place a premium on everyone's right to a perspective and to express oneself without judgment, whereas evaluativists may be more likely to actually listen to what students have to say (Clinchy 2002; Tabak and Weinstock 2011). Clinchy (2002) argued that accepting everyone's point of view as valid, because there is no way to judge subjective points of view, is not the same as trying to understand others' points of view, which involves evaluation.

Another area meriting follow-up would be to investigate whether an explicit focus on epistemology while educating teachers would produce more autonomy-supportive behavior. Epistemological change has long been seen as an educational byproduct requiring a long developmental span. However, recently, several efforts to teach with the intention of shifting epistemology have yielded results, despite the difficulty involved in attaining such progress (Brownlee and Berthelsen 2008; Kienhues et al. 2008; Valanides and Angeli 2005). Apart from testing the hypothesis that teachers' epistemologies do affect aspects

of their teaching, such research would provide an important impetus for developing instructional interventions that aim to foster epistemological change.

Given that types of teachers' motivation and their personal epistemological beliefs have been found related to AST, it seems worthwhile to consider the conceptual relation between them. Along with the conceptions of the nature of knowledge and knowing that come with different epistemologies, it has been posited the personal epistemology has a dispositional, value-laden character. According to Kuhn (2001), someone with a relativist epistemology, believing that knowledge is uncertain and constructed, would more likely value examining beliefs and finding things out. Likewise, a teacher who is autonomously motivated would act according to internally held values (Roth et al. 2007). In contrast, a teacher with an objectivist epistemology would have less reason to value such activities, as knowledge is given, external, and certain, and, like a teacher who is not autonomously motivated, would be less likely to support the autonomous knowledge building process in students (Roth et al. 2007). Although there is no research we are aware of regarding relationships between personal epistemology and motivation as conceived of in self-determination theory, personal epistemology has been found related to motivation as conceived of in expectancy-value theory (Buehl and Alexander 2005; Paulsen and Feldman 1999) and achievement goal theory (Bråten and Strømsø 2004; Ricco and Rodriguez 2006), although not with reference to teachers. In the closest analogy, although referring to different constructs of motivation and support for learners, Ricco and Rodriguez (2006) found that mothers who viewed knowledge as constructed also tended to have authoritative parenting styles and preferred their children to adopt learning goals. In contrast, those who viewed knowledge as consisting of unambiguous facts tended to have either authoritarian or permissive parenting styles and preferred their children to adopt the more externally oriented performance goals. That is, a relationship was found between epistemological beliefs and motivational goal orientations, and this relationship was reflected in the type of support the parent would give to the learner.

Furthermore, future research would do well to explore additional personal characteristics of teachers as possible antecedents of AST. As far as we know, only two studies have investigated such antecedents. These studies found that teachers' autonomous motivation toward teaching (Roth et al. 2007) or teachers' general autonomous orientation (Reeve 1998) predicted their AST. Studying personal characteristics of teachers as antecedents for their behaviors may shed some light on specific avenues for designing teacher training programs to facilitate AST, thereby facilitating students' internalization, autonomous motivation,

interest-focused investment in class, and wellbeing (Roth et al. 2007).

Finally, future research will do well to explore other school related factors that may predict AST. A neglected area of exploration involves schools principals' behaviors and practices as possible predictors of AST. The lack of research on this topic is surprising especially when compared to the rich research literature concerning teachers' orientations toward autonomy and AST and their relationships to students' outcomes (e.g., Assor et al. 2002; Deci et al. 1981; Grolnick and Ryan 1987; Reeve 2002; Reeve et al. 1999, 2003; Vallerand et al. 1997). Past findings showing that environmental pressures may undermine teachers' autonomy support may be attributed, in part, to principals' practices and policy. In addition, environmental pressures may also come from curriculum standards and governmental policy.

In sum, given the importance of autonomy supportive teaching for students' outcomes, it seems valuable to explore factors that may enhance or undermine teachers' tendency to nurture students' autonomy. Few studies that did explore this question focused on two groups of factors: contextual conditions and teachers personal characteristics. The present research explores a specific characteristic of teachers, and found that teachers' more relativist epistemological beliefs, which assert that multiple legitimate perspectives on knowledge may exist, are more likely to be perceived by their students as autonomy supportive. This perception, in turn, predicts students' internalization.

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