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School principals' systems thinking: antecedents and consequences

School principals' systems thinking

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Abstract

Purpose – Today's educational complexities require principals to adopt a more systemic perspective toward school management. Although research has emphasized the benefits associated with the holistic perspective of systems thinking, research in the educational field has been limited. The purpose of this paper is to investigate the mediating role of principals' systems thinking (PST) in the relationships between instructional leadership (IL) and subject coordinators' organizational commitment and job satisfaction.

Design/methodology/approach – Data were collected by surveying a sample of 226 subject coordinators from different elementary schools randomly chosen in Israel. Subject coordinators completed questionnaires on their PST competencies, their principals' IL, job satisfaction and organizational commitment. Structural equation modeling was used to test the research hypotheses.

Findings – The results confirmed the main hypotheses: PST did facilitate subject coordinators' organizational commitment and job satisfaction. Findings also showed that PST mediated the relationship between IL and subject coordinators' organizational commitment and job satisfaction.

Originality/value – By integrating research from both educational and non-educational literature, this study contributes to deepen our understanding regarding the antecedents and consequences of the PST as perceived by their subject coordinators, providing a broader leadership framework on their functions in today's complex school systems.

Keywords Principals, System thinking, Job satisfaction, Organizational commitment, Subject coordinators
Paper type Research paper

Introduction

A school is an inherently complex organization, involving a vast number of interacting functions, people and purposes (Crick *et al.*, 2017). Practitioners and researchers alike agree that recent years have brought even more challenging intricacies to school leadership (Fullan, 2014; Saiti, 2015). Therefore, current principals facing today's educational complexities may benefit from the holistic perspective of systems thinking (ST), which emphasizes understanding the system as a whole before studying its parts, while simultaneously considering an array of influencing factors (Shaked and Schechter, 2017). Research showed that principals' systems thinking (PST) may yield a number of positive effects including improved school and teacher outcomes (Pang and Pisapia, 2012). Yet, ST has been hardly studied in the educational leadership field in relation to faculty members' job attitudes (Bui and Baruch, 2012).

Over the past several decades, the single-leader model has been progressively eroding as the requirements of the job have come to exceed the capacity of a single individual (Day *et al.*, 2016). Principals have increasingly come to rely for support on school middle-leaders such as department heads, grade-level coordinators and subject coordinators (Bush and Glover, 2014). Middle-leaders constitute the "intermediate layer" in the school's organizational structure,

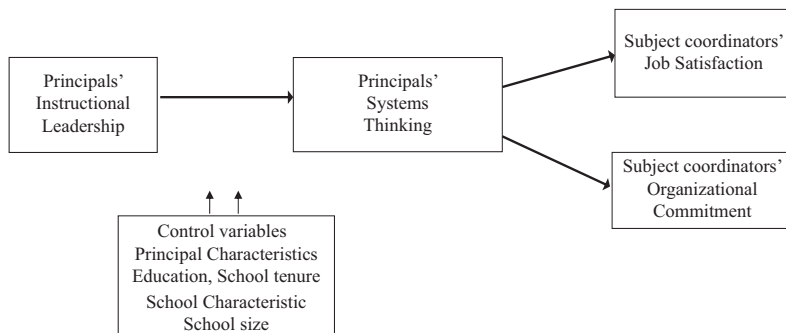


located between the senior leadership and the classroom teachers (Gurr and Drysdale, 2013). Specifically, scholars have shown that subject coordinators are critical to a school's successful functioning in complex situations (Day *et al.*, 2016). Researchers found that the subject coordinator role had a significant influence on school performance and student results (Leithwood, 2016). Operating in an environment of constant and extensive external demands and reforms, subject coordinators are the motivating force driving for change. Among other important roles, they coordinate teachers' pedagogical tasks, thereby contributing toward academic improvement (Somech and Naamneh, 2019). Research indicates that one fundamental factor that may have a substantial impact on subject coordinators' attitudes toward their work and workplace is the principal's leadership (Bush and Glover, 2014). Accordingly, this study aimed to investigate the consequences of PST on their subject coordinators' job attitudes.

According to Shaked *et al.*'s (2018) conceptualization, PST includes four major competencies through which principals apply ST in their schools – first, evaluating significance refers to the principal's ability to envision elements of school life according to their significance for the entire system. Second, openness to a variety of opinions refers to the principal's willingness to listen to diverse people and ideas, which derives from the principal's self-awareness of his/her own limitations and readiness to learn from others. Third, leading wholes refers to principal's holistic perspective, oriented toward seeing the big picture and not only its individual parts. Fourth, adopting a multidimensional view refers to the principal's contemplation of several aspects of a given issue simultaneously, by attributing that issue's emergence and existence to a wide range of potential sources. Their conceptualization of ST draws upon Bertalanffy's (1968) claim that the only way to fully understand why a phenomenon arises and persists is to understand its parts in relation to the whole. This approach reflects the open system approach: every phenomenon must be viewed from the perspective of the whole system to which it belongs as well as its subsystems and the relationships between its various components (Hammond, 2005).

Following Shaked *et al.*'s (2018) conceptualization of PST, the present study proposed to investigate the antecedents and consequences of PST as perceived by their subject coordinators. Specifically, the study model posited that PST activities would mediate the relationships between principals' instructional leadership (IL) and subject coordinators' organizational commitment and job satisfaction (please see Figure 1). Such investigation is important because organizational commitment and job satisfaction are related to school effectiveness and a positive and healthy school work environment (Bogler and Nir, 2015; Skaalvik and Skaalvik, 2017). IL was selected as an antecedent of PST because it involves not only a wide range of activities aiming at improving teaching and learning and garnering school-wide commitment (Hallinger and Wang, 2015) but also due to its

Figure 1. Proposed research model: principals' systems thinking mediates the relations between principals' instructional leadership and subject coordinators' job satisfaction and organizational commitment



relevance to subject coordinators' core pedagogical and administrative functions in the school operation. Yet, studies have investigated IL and ST leadership models separately, few, if any, have inquired whether principals' IL behavior may be a predictor of PST as perceived by subject coordinators.

Although some scholarly attention has been given to advancing research on school leadership and ST, several gaps remain in the literature. First, despite the educational field's growing complexities and climate of outcome-based accountability, which call for systemic perspectives in managing schools (Kruse, 2018), existing research on PST remains limited (Shaked and Schechter, 2017). Second, research has indicated that individual competence and leadership are antecedents to ST and additionally that ST tends to positively influence job outcomes and behaviors (Bui and Baruch, 2010, 2012), calling for exploration of such antecedents and outcomes for PST tendencies in school leadership. Third, despite the increasing importance of the contribution of subject coordinators' role (Leithwood, 2016; Somech and Naamneh, 2019), no studies have examined the role of PST activities in enhancing subject coordinators' job attitudes. The goal of the present study, then, is to address these important yet relatively unstudied issues by exploring a model that investigates the antecedents and consequences of PST as perceived by subject coordinators.

Theoretical background and hypotheses

School principals as system thinkers: antecedents and consequences

According to the ST framework, organizations are complex systems composed of interconnected parts studied as an evolving whole, with emergence and interdependencies as major concepts (Bousquet and Curtis, 2011). ST does not try to break systems down into parts in order to understand them but rather concentrates on how the parts function together in networks of interaction (Senge, 2006). Hence, ST searches for explanations, clarifications, perspectives, notions, assumptions and conclusions – differently from those produced by traditional scientific management frameworks. This approach generates more occasions to learn and inquire about the network's complexities and details, and to study the arrangements and interactions among subsystems (Stacey *et al.*, 2000). Yet, none of these are understandable without contextualization (Dale and Newman, 2005). A system as a whole coexists in relation to an environment; its functioning is maintained by managing a continuous flow of resources from its environment (Hoy and Miskel, 2013; Leithwood *et al.*, 2017). Flows of resources ensue through the organization's interrelated parts via feedback loops (circular cause–effect relations underlying the changes that occur over time in a system's behavior), with the main goal of securing improvement by adapting the system to align with the required change (Gharajedaghi, 2011).

Management scholars have increasingly recognized that schools are becoming more open systems, exposed to external influences interacting with other external systems such as economic, political and global systems, through which they secure new properties and resources (Brezicha *et al.*, 2015). Within the context of school improvement, principal leadership activities are aimed to keep the school system in a steady-state through leadership activities both within the school and between the school and its environment (Benoliel, 2017; Tejada and Ferreira, 2014). PST as a leadership strategy may thus be most appropriated, enhancing individual and school outcomes because school functioning is highly dependent upon both staff's job attitudes and stakeholders' actions, especially when resolving complex matters (Crick *et al.*, 2017; Leithwood *et al.*, 2017). In this regard, several researchers have demonstrated how managers' application of ST assisted them to enhance workers' job attitudes and cope successfully with complex situations. For example, by improving school administrators' understanding of the impact of each decision on the organization, ST was found to enable school administrators to make better decisions that tended to improve student achievement (Marshall and Fisher, 2018;

Thornton *et al.*, 2004). ST was also found to provide effective means to address the challenges of teacher retention (Minarik *et al.*, 2003).

In the context of the US No Child Left Behind federal legislation, ST was proposed as a useful tool to help educational leaders see public relations as a continual, systematic process that is essential for engaging the school community's support to improve students' learning and faculty's job attitudes (Chance, 2005). Dyehouse *et al.* (2009) argued that ST can provide a framework for representing many of the components in a complex curricular program, thus serving as a more precise and explicit method of interpreting and assessing program results than existing methods. Similarly, Wells and Keane (2008) demonstrated how ST may be implemented to develop professional learning communities in schools. One rare quantitative study on ST effectiveness (Pang and Pisapia, 2012) identified Hong Kong school principals' holistic ST-based leadership approach as the strongest predictor of school leaders' effectiveness, teachers' trust and commitment to school vision, distinguishing between more effective and less effective leaders.

More recently, Shaked *et al.* (2018) identified four characteristics of PST, through which effective principals apply the ST approach in their schools, as discussed above: evaluating significance, openness to a variety of opinions, leading wholes and adopting a multidimensional view. Considering that PST helps principals see the deeper patterns underlying actions and details, the study proposes that such competencies may enable principals to identify actions to facilitate job attitudes of subject coordinators. Subject coordinators' important role in fostering their schools' gains in pedagogical practices and academic outcomes has been recognized in educational research from many countries around the world (Carter, 2016; Ng and Chan, 2014; Somech and Naamneh, 2019), especially within educational contexts highly focused on measurable student achievements (Hunt, 2013). Research showed that improvements in subject coordinators' job attitudes largely reflect the relationship with their principals, as well as principals' application of ST assists in enhancing faculty members' job attitudes (Gurr and Drysdale, 2013). Therefore, the goal of this study was to investigate the antecedents and consequences of PST as perceived by their subject coordinators.

Principals' instructional leadership as an antecedent of principals' systems thinking

The most frequently used conceptualization of IL (Hallinger, 2011) outlines three dimensions of IL: defining the school's mission; managing, monitoring and developing the school's instructional program; and developing a positive school learning climate. Research shows that instructional leaders pay particular attention to the main goal of schooling, thus coordinating the school academic program (Neumerski, 2012). IL helps managers to focus not only on the "trees" (i.e. particular situations, limited domains) but also on the "forest" – an overall view. Such a focus may facilitate PST which presupposes that most thinking, experiencing, practices and institutions are interconnected (Cheng, 2011). Also, instructional leaders consider the interplay between actions and responses according to a set of purposes (Hallinger, 2011). This emphasis on the interrelatedness of goals may be related to a PST approach because it necessitates reviewing the system to identify its interconnections and then forming solutions based on this deeper understanding (Wells and Keane, 2008).

Moreover, as pointed by Fullan (2014), principals' ability to think systemically depends on their capacity to think strategically. Strategic thinking requires competent planning, anticipation and an understanding of actions' interdependency within a social system, implying focused coordination of resources. Instructional leaders are skilled at thinking strategically (Robinson *et al.*, 2009). IL necessitates leaders to synthesize a wealth of information before making decisions and establishing courses of action that promote improvement (Brazer and Bauer, 2013). Indeed, IL involves successful exploitation of data acquired both from internal and external resources for instructional decision making

(Osborne-Lampkin and Cohen-Vogel, 2014). Such skills may be related to PST competencies, which focus on how the parts of a system operate in intimate interconnections, by understanding parts' interactions that create the whole and that shape its defining characteristics (Gharajedaghi, 2011).

Furthermore, PST can be built only by understanding the "structures" that underlie complex situations and by visualizing profound changes (Bui and Baruch, 2010). IL involves development of school-based learning communities that provides meaningful staff development, where educators collaborate to innovate teaching pedagogies and to improve students' academic achievement (Hallinger *et al.*, 2013). IL practices sustain a school vision that establishes clear learning goals and garners school-wide commitment to these goals, leading principals to focus on the system as a whole as well as on the interrelations among the system's components (Rigby, 2014; Stronge *et al.*, 2008). Hence:

H1. There is a positive relationship between principals' IL and PST.

Subject coordinators' job satisfaction and organizational commitment as outcomes of principals' systems thinking

In investigating subject coordinators' job attitudes, we have focused on job satisfaction and organizational commitment. According to the study model, PST is positively related to subject coordinators' outcomes of job satisfaction and organizational commitment.

Job satisfaction. Job satisfaction, the most intensively covered attitude in the organizational psychology literature (Judge and Kammeyer-Mueller, 2012), has been defined in various complementary ways that implicitly contain both affects (feelings) and cognitions (evaluations, beliefs). Thus, job satisfaction represents the individual's mental state in relation to his or her work or work environment, resulting from positive or negative appraisal of his or her job or job experiences (Robbins and Judge, 2016). Job satisfaction has been suggested to be related to perceived fulfillment of one's needs through work (Kreis and Brockopp, 1986) and of one's job-related needs at work for teachers in schools (Hsieh, 2016).

Theoretically, PST could enhance job satisfaction through motivational mechanisms. Previous research has identified working conditions and the principal leadership activities as factors enhancing teachers' job satisfaction (Bogler and Nir, 2015; Skaalvik and Skaalvik, 2017). Principals who engage in ST activities seek to understand the full picture by listening to other points of view and are thus willing to listen to others and learn from others (Wells and Keane, 2008). Thus, principals engage in dialogue with those holding educational perceptions, such as subject coordinators, that may differ from their own (Shaked *et al.*, 2018). This dialogue enables principals to analyze school functioning and to design alternative systems and solutions by exploring how people and elements in the school environment interact (Bousquet and Curtis, 2011). PST may therefore provide the conditions for intrinsic motivation, offering subject coordinators appropriate support, thereby enhancing job satisfaction (Cheng, 2011).

Furthermore, by encouraging a more cooperative approach between leaders and staff, PST gives subject coordinators more responsibility for school improvement based on a deeper understanding of the school system (Wells and Keane, 2008). Thus, by consulting with subject coordinators, to ask for their ideas and recommendations in order to generate new knowledge, PST enables interactions between school faculty members, allowing information exchange and knowledge exploration (Price-Mitchell, 2009; Schechter and Qadach, 2012). As such, subject coordinators may feel more pride and satisfaction arising from more challenging, growth-enhancing opportunities (Dou *et al.*, 2017):

H2a. There is a positive relationship between PST and subject coordinators' job satisfaction.

Organizational commitment. Organizational commitment was defined by Mowday *et al.* (1979), as “the relative strength of an individual’s identification with and involvement in a particular organization” (p. 226). Reflecting individuals’ evaluation of organizations’ work conditions (Joo *et al.*, 2012), organizational commitment comprises three factors: identification – acceptance of the organization’s goals and values, involvement – willingness to invest effort on the organization’s behalf and loyalty – the importance attached to keeping up membership in the organization (Bogler and Somech, 2004). Several studies indicated that subject coordinators’ organizational commitment can be an important predictor of their performance since it is positively related to their dedication to attain school goals (Bogler and Nir, 2015; Park, 2005).

Research has indicated that teachers perceive higher organizational commitment when their principal demonstrates high levels of consideration and supportive behavior (Meyer, 2016; Northouse, 2016). Similarly, positive teacher–principal interactions were central components found to explain organizational commitment (Bogler and Nir, 2015). PST is characterized by striving for the whole school’s success, not just one’s personal success (Bui and Baruch, 2010). In this sense, previous research reported that more frequent actions taken to accomplish school goals, such as considering elements of school life according to their significance for the entire system, ensure teaching staff’s identification with the school’s aspirations and values (Pang and Pisapia, 2012; Shaked and Schechter, 2017). This, in turn, may predispose subject coordinators to demonstrate greater commitment to the school system (Joo and Park, 2010; Meyer, 2016). Hence:

H2b. There is a positive relationship between PST and subject coordinators’ organizational commitment.

Mediation model

Based on the reviewed theoretical perspectives, we proposed that PST would mediate the relationships between IL and subject coordinators’ job satisfaction and organizational commitment. The proposed hypothesized model coincided with Bui and Baruch’s (2010, 2012) call for analyzing antecedents and outcomes of the five disciplines depicted in Senge’s (2006) learning organization framework, namely, personal mastery, team learning, mental model, shared vision and ST. In this framework, ST is the linchpin of the learning organization, integrating all disciplines, fusing them into a coherent body of theory and practice. Accordingly, we focused on ST and proposed that ST thus plays the role of mediator, facilitating the influence of antecedents and integrating their effects toward the desired outcomes. Hence, this study postulates an integrative model: IL functions to enhance subject coordinators’ job satisfaction and organizational commitment through the mechanism of PST. Therefore, we posit that PST serves as a vehicle whereby IL enhances subject coordinators’ job satisfaction and organizational commitment:

H3. PST mediates the relationships of principal IL to (a) subject coordinators’ job satisfaction and (b) subject coordinators’ organizational commitment.

Method

Participants and procedure

Data collection was performed in several steps. After the research project was approved by the Ministry of Education, schools were randomly selected from a list of elementary schools provided by the Ministry of Education. We first contacted the principal, explained the study’s purpose, and emphasized the importance of candid answers. To avoid the issue of school membership interdependence, data were collected from a sample of 226 subject coordinators from 226 elementary schools randomly chosen in Israel. Only subject coordinators that belonged to the school management team (SMT) were chosen to

participate in the present study. SMTs typically consist of senior personnel such as the principal, deputy principals and other key school officials. The SMTs' main duties involve managerial and pedagogical responsibilities (Abbott and Bush, 2013) and principals typically serve as the leaders of SMTs (Thorpe and Bennett-Powell, 2014).

The core purpose of the subject coordinator in Israel is to provide professional leadership and management for a specific subject (e.g. literacy, math and sciences) to ensure high-quality instruction and improved achievement for all students. Among other responsibilities, a subject coordinator supports, guides and motivates teachers of the subject, evaluates the effectiveness of teaching and determines future priorities and targets for the subject. Therefore, the major task of a subject coordinator is similar to the common descriptions of their duties in the US and European countries (Bennett *et al.*, 2007).

Subject coordinators participated voluntarily through survey questionnaires; they completed questionnaires on their principals' ST competencies, their principals' IL, job satisfaction and organizational commitment. Although our data may be vulnerable to the inflation of correlations by common method variance due to the use of a common source, we reasoned that subject coordinators would be better able to assess their own attitudes than independent parties. Moreover, caution was taken to minimize the impact of potential common method bias as suggested by Podsakoff *et al.* (2003). We guaranteed our participants anonymity and response confidentiality. Both principals and subject coordinators provided some demographic information.

School size was based on the number of enrolled students with an average mean of 407.81 students (SD = 163.02) per school. Distribution of the school size ranged between 35 and 750 enrolled students, with a median: 400, skewness: -0.025 and kurtosis: -0.672 indicating a normal distribution (Curran *et al.*, 1996). Subject coordinators (62 percent women) had a mean age of 39.06 years (SD = 7.34) and mean job tenure in the profession of 12.29 years (SD = 7.52), with 70.4 percent holding a bachelor's degree and 28.3 percent holding a master's degree. The principals (66 percent women) had a mean tenure in the present school of 8.84 years (SD = 6.06) and at least a bachelor's degree (15.6 percent), with 74.4 percent holding a master's degree and 5 percent holding a doctorate.

Measures

Principals' instructional leadership. To assess the frequency at which a principal displayed IL behaviors, the 31-item abbreviated version of the Principal Instructional Management Rating Scale, which was originally developed by Hallinger and Murphy (1985) and slightly adapted to the Israeli context and elementary school level, was used. This version has demonstrated adequate reliability and validity estimates (Schechter and Qadach, 2016). The CFA indicated acceptable goodness-of-fit indexes ($\chi^2(62) = 170.07$, comparative fit index (CFI) = 0.903, incremental fit index (IFI) = 0.904, root mean square error of approximation (RMSEA) = 0.081).

Based on CFA, IL involves three dimensions: defining the school's mission (e.g. "Defines the responsibilities of the team in achieving the school's educational goals"), managing the instructional program (e.g. "Clarifies who is responsible for coordinating the curricula") and promoting a positive school learning climate (e.g. "Praises students for high achievements through reinforcements such as prestigious roles or mentioning them in the school paper or website"). Subject coordinators rated principals' IL on a six-point Likert scale ranging from never (1) to always (6).

Principals' systems thinking. To assess the frequency at which a principal displayed ST competencies, subject coordinators answered the 17-item PST scale validated for schools by Nadav (2018). The CFA indicated good goodness-of-fit indexes ($\chi^2(50) = 118.64$, CFI = 0.929, IFI = 0.931, RMSEA = 0.078). Based on CFA, PST includes four ST competencies: evaluating significance (e.g. "The principal tends to take unexpected occurrences into account"); openness

to a variety of opinions (e.g. “The principal engages in dialogue with those holding educational outlooks that differ from his/her own”); leading wholes (e.g. “The principal attempts to identify repetitive patterns in the information at hand”); and adopting a multidimensional view (e.g. “During decision-making, the principal tends to view the entire picture before examining its details”). Subject coordinators rated the PST competencies on a five-point Likert scale ranging from never (1) to always (5).

Subject coordinators’ job satisfaction. Subject coordinators’ job satisfaction was assessed using Zak’s (1975) ten-item scale (e.g. “Overall I’m satisfied with my job”). Subject coordinators responded on a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

Subject coordinators’ organizational commitment. To measure subject coordinators’ organizational commitment, we have used Mowday *et al.*’s (1979) Organizational Commitment Questionnaire, adapted by Somech and Bogler (2002) which was specifically adjusted to suit the educational setting context. This 15-item scale assesses the strength of an individual’s identification with and involvement in a particular organization (e.g. “I talk about this school to my friends as a great school to work for”). Subject coordinators responded on a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

Control variables. In the present study, school size and principals’ education and tenure (number of years working in the same school) were used as control variables. Previous research has indicated that organization size is related to leader’s IL and positively correlated with organizational performance (Barnett *et al.*, 2002; Berson *et al.*, 2015). Both principal tenure and principal education were shown to correlate with principals’ leadership tendencies toward management and/or toward instructional tasks (Louis and Robinson, 2012).

Data analysis

This study performs the analysis with a two-step structural equation modeling (SEM) approach (Anderson and Gerbing, 1988), including measurement model and structural model testing. CFA was used to test the measurement model and SEM (AMOS 21.0) was used to test the structural model and to evaluate the relationships among the constructs, as proposed in the conceptual model in Figure 1 (Jöreskog and Sörbom, 1996). SEM was used because, first, it allows to test series of relationships between variables and get estimated parameters simultaneously. Second, SEM has become the dominant analytical tool for testing cause–effect relationship models with latent variables.

To account for the mediation effects, the complete mediation model was tested using the SEM approach suggested by James *et al.* (2006). First, it allows for testing of full as well as partial mediation; if testing for partial mediation, a direct path is added from the initial variable to the outcome variable. Second, simultaneous testing of the significance of both the path from an initial variable to a mediator and the path from the mediator to an outcome (the test SEM applies) provides the best balance of Type I error rates and exhibits greater statistical power relative to other approaches (MacKinnon *et al.*, 2002).

In the present study, the full mediating model describes the relationships between the principals’ IL (initial variable) and PST (mediating variable), and between PST (mediating variable) and subject coordinators’ job attitudes of job satisfaction and organizational commitment (outcome variables). To support the full mediation, the mediation effects of PST were tested by comparing the fully mediated (hypothesized) model (M1) with an alternative, partially mediated model (M2) for subject coordinators’ job attitudes. Specifically, M2 added a possible direct effect between principals’ IL and subject coordinators’ job satisfaction and organizational commitment.

Because SEM is primarily based on model fitting and selection, we used the fit indices of χ^2 statistic divided by degrees of freedom (χ^2/df), CFI, Tucker–Lewis index (TLI), IFI and RMSEA to assess the fit of the research model (Jöreskog and Sörbom, 1996) and path

estimates to describe how well the models estimate the input data set (Bollen, 1989). The χ^2 values provide a statistical basis for comparing the relative fit of nested models. Significant improvement in fit for M1 over M2 would confirm the mediation effects of PST. Finally, the bootstrapping procedure based on a 2,000 bootstrap sample size to ascertain the presence of indirect effects was used (Preacher and Hayes, 2008). The bootstrapping approach is recommended for analyzing indirect effects when testing for mediation in small samples due to biased variance and standard error estimates using conventional mediation approaches (Hayes, 2013). To enable bootstrapping in the AMOS statistical software package, missing values in the data set were imputed using regression imputation.

Results

The descriptive statistics, internal reliability, average variance extracted (AVE), maximum shared variance (MSV) and inter-correlations among study variables are presented in Table I.

Hypotheses testing and overall model fit

Measurement model testing. We first conducted a CFA to determine unidimensionality, discriminant validity and convergent validity of the variables (Jöreskog and Sörbom, 1996). We validated the construct measures for the PST, IL and subject coordinators' job satisfaction and organizational commitment using CFA, which is most suitable for confirming whether construct measures load on their respective *a priori* defined constructs (Browne and Cudek, 1993). The measurement model provided a good fit to the data (χ^2 (571) = 838.230, CFI = 0.919, TLI = 0.911, IFI = 0.921, RMSEA = 0.045) and all of the indicators had statistically significant ($p < 0.01$) factor loadings (> 0.50) on their intended constructs, establishing the posited relationships among indicators and constructs (Hair *et al.*, 1998). During content validation procedures, some of the scale items were eliminated.

Convergent validity (Table I) was achieved by meeting the three following conditions (Fornell and Larcker, 1981). First, all factor loadings in CFA were significant at $p < 0.001$. Second, the AVE for all research constructs exceeded 0.50, indicating that the items of the proposed scales explain sufficient variance in the underlying construct than that attributable to the measurement error. Third, the reliabilities for each of the proposed constructs were higher than 0.70. So, convergent validity was achieved.

Regarding discriminant validity: first, AVE should be greater than 0.50 (Fornell and Larcker, 1981). Second, AVE should be greater than MSV. As seen in Table I, AVE of PST, IL, job satisfaction and organizational commitment meet these conditions. So, discriminant validity was achieved for the measurement model. The CFA thus confirmed that the IL, PST and work attitude scales measured distinct constructs.

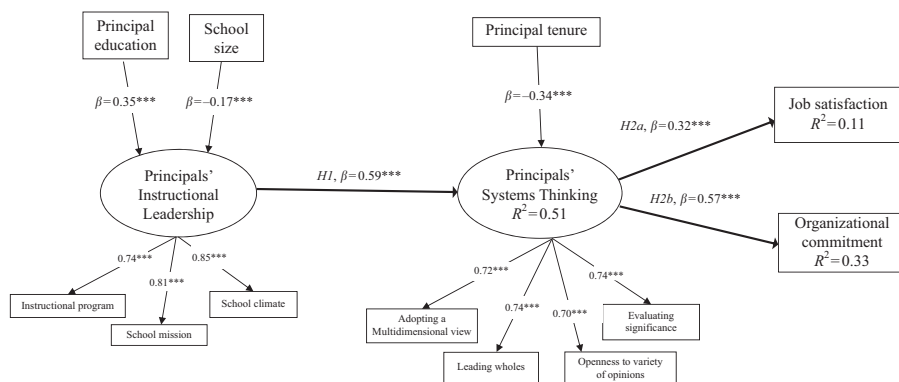
Structural model testing. As seen in Figure 2, the hypothesized fully mediated model (M1) presented a good fit to the data (χ^2 (49) = 88.142; $\chi^2/df = 1.799$; CFI = 0.956; IFI = 0.957; TLI = 0.941; RMSEA = 0.059). Comparison of fit for the proposed hypothesized model (M1) against the competitive partially mediating model (M2) showed no significant gains in explanatory power for the alternative model ($\Delta\chi^2$ (2) = 3.69, $p > 0.10$), although M2 exhibited good fit indices (χ^2 (47) = 84.450; $\chi^2/df = 1.797$; CFI = 0.958; IFI = 0.959; TLI = 0.941; RMSEA = 0.059). These results suggested that the full mediation model (M1) fits the data better than the partial mediation model (M2).

In the present study, school size and the principal characteristics of tenure and education were used as control variables in testing all the hypotheses. As seen in Figure 2, the control variables were all significant. Moreover, findings (see Figure 2) indicated that principals' IL explained 51 percent of the variance in PST, and PST explained 33 percent of the variance in organizational commitment and 11 percent of the variance in job satisfaction.

Table I.
Descriptive statistics,
AVE, MSV and
intercorrelation matrix
for study variables

	<i>M</i>	AVE	MSV	α	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1. IL: total	3.87 (0.78)	0.88	0.42	0.89	1	0.83***	0.87***	0.90***	0.53***	0.49***	0.36***	0.39***	0.43***	0.28***	0.37***	-0.19**	0.33**	-0.16*
2. IL: school mission	3.82 (0.95)			0.75	1	0.61***	0.67***	0.90***	0.47***	0.44***	0.27***	0.35***	0.42***	0.27***	0.39***	-0.26***	0.32***	-0.18**
3. IL: instructional program	3.84 (0.83)			0.78	1	0.63***	0.37***	0.63***	0.37***	0.35***	0.26***	0.26***	0.30***	0.15*	0.19**	-0.09	0.28***	-0.12
4. IL: climate	3.93 (0.91)			0.80	1	0.53***	0.49***	0.53***	0.49***	0.49***	0.38***	0.40***	0.42***	0.30***	0.40***	-0.17***	0.27***	-0.13*
5. PST: total	3.60 (0.58)	0.64	0.41	0.87		1	0.76***	0.63***	1	0.76***	0.79***	0.83***	0.78***	0.28***	0.52***	-0.40***	0.13*	-0.06
6. PST: evaluating significance	3.57 (0.72)			0.71		1	0.47***	0.50***	1	0.47***	0.47***	0.50***	0.46***	0.17***	0.45***	-0.32***	0.13*	-0.11
7. PST: openness to a variety of opinions	3.67 (0.69)			0.77		1	0.57***	0.47***	1	0.57***	1	0.57***	0.47***	0.23***	0.34***	-0.35***	0.02	-0.09
8. PST: leading wholes	3.57 (0.77)			0.76		1	0.53***	0.49***	1	0.53***	1	0.53***	0.47***	0.23***	0.41***	-0.35***	0.10	-0.03
9. PST: adopting a multidimensional view	3.58 (0.77)					1			1									
10. Job satisfaction	3.87 (0.64)	0.50	0.45	0.79									1	0.24***	0.42***	-0.27***	0.15*	0.04
11. Organizational commitment	3.66 (0.71)	0.51	0.46	0.82									1	0.55***	-0.15*	0.02	-0.09	-0.09
12. Principal tenure	10.10 (4.56)												1					
13. Principal education	1.97 (0.42)												1					
14. School size (number of enrolled students)	407.81 (163.02)												1					

Notes: *n* = 226. IL, principals' instructional leadership; PST, principals' system thinking; AVE, average variance extracted; MSV, maximum shared variance. Principal education was coded 1 = BA; 2 = MA; 3 = PhD. **p* < 0.05; ***p* < 0.01; ****p* < 0.001



Notes: Standardized parameter estimates for the theoretical model; $\chi^2(49)=88.142$; $\chi^2/df=1.799$; CFI=0.956; IFI=0.957; TLI=0.941; RMSEA=0.059; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Figure 2. SEM results for the proposed full mediation model (M1)

In line with the first hypothesis, findings (see Figure 2) indicated that IL was positively and significantly correlated to PST ($\beta = 0.59, p < 0.001$). Results also supported both parts of the second hypothesis, whereby PST positively and significantly correlated to job satisfaction ($\beta = 0.32, p < 0.001$) and to organizational commitment ($\beta = 0.57, p < 0.001$) (see Figure 2). Finally, findings also supported the third hypothesis, indicating that PST fully mediated the relationships between IL and subject coordinators' job satisfaction and organizational commitment. Bootstrap analyses conducted to provide a more rigorous test of whether the mediated effects found in the model were statistically significant (Shrout and Bolger, 2002). Data showed that the indirect effect of IL via PST was 0.34 on organizational commitment (lower bound = 0.22, upper bound = 0.48, $p = 0.001$) and 0.19 on job satisfaction (lower bound = 0.08, upper bound = 0.32, $p = 0.001$), confirming our hypotheses (see Table II).

Discussion

The present study was geared toward examining the leadership-related antecedents of a ST approach upheld by the principal, as perceived by subject coordinators, and the possible improvements in subject coordinators' job attitudes in relation to PST. The call for a more holistic approach to school leadership research and practices (Leithwood *et al.*, 2017) motivated the current study. Specifically, the present model examined the mediating role of PST in the relationships of principals' IL with regard to subject coordinators' organizational commitment and job satisfaction. Overall, our results provide additional support to previous research argument of reframing schools as complex systems in which faculty members

Mediation pathway	X-M Path a	M-Y Path b	Mediation Effect	Bootstrapping Confidence interval (95%)	
				Upper	Lower
Instructional leadership → PST → organizational commitment	0.59***	0.57***	0.34***	0.48	0.23
Instructional leadership → PST → job satisfaction	0.59***	0.32***	0.19**	0.32	0.08

Notes: Results of SEM and bootstrapping for predicting the relationship of instructional leadership to PST (mediator) on organizational commitment and job satisfaction (outcome variables) PST, principal systems thinking. ** $p < 0.01$; *** $p < 0.001$

Table II. Results of SEM and bootstrapping

should be encouraged to engage with an extended set of practices, concepts, resources and sources of support (Crick *et al.*, 2017; Kruse, 2018).

First, the findings presented herein provide support for the linkages proposed in the model and support the proposition that the PST competencies of evaluating significance, leading wholes, adopting a multidimensional view and openness to a variety of opinions contribute to enhance the subject coordinators' job satisfaction and organizational commitment. Furthermore, the findings show that the PST mediates the relationships between principal's IL and subject coordinators' job satisfaction and organizational commitment. Through PST, principals articulate a theory of action to manage the system and its components and leverage their interrelationships (Marshall and Fisher, 2018). Principals can enhance faculty members' job attitudes by conceptualizing various aspects of school life as one large system. This is brought about by an ability to understand that a current situation's seemingly separate or confusing details are actually parts of one big picture.

Opportunities for a more meaningful and supporting workplace, through adopting a multidimensional view and openness to a variety of opinions, seem to contribute to enlarging the scope of subject coordinators' perspectives, from issues that are unique to their own subject to matters affecting the school organization as a whole. Similarly, evaluating significance and leading wholes on the part of the principals so as to envision elements of school life in light of their importance to the whole system seem to enhance the ability to develop an organizational system approach, which expands middle-leaders' (i.e. subject coordinators) understanding of the school system as a whole. This expanded scope may reinforce the commitment-related values of subject coordinators and job satisfaction.

These results also coincided with previous research that pinpointed work conditions and inner workplace support as significant predictors of commitment and satisfaction at the workplace (Collie *et al.*, 2011; Dou *et al.*, 2017). Previous research indicated that PST provides subject coordinators with more responsibility for school improvement based on a deeper understanding of the school system's "big picture," thereby encouraging the expansion of cooperation between principals and subject coordinators (Wells and Keane, 2008). Thus, through PST competencies, namely, leading wholes, adopting a multidimensional view, evaluating significance and openness to a variety of opinions, principals may improve schools' work environment, promoting subject coordinators' job satisfaction and organizational commitment. These results deepen our knowledge of the significance of PST in relation to subject coordinators' attitudes toward their work and workplace.

Second, the present findings indicated a positive relationship between IL and PST. It seems that IL allows principals to "filter out" the less essential elements of the school's complex and dynamic reality, while analyzing the most important instructional issues that need to be addressed, thereby promoting the conditions that enable the enactment of ST (Walker and Slear, 2011). By aggregating and integrating various data sources into a multidimensional framework, instructional leaders facilitate a holistic perspective that focuses on how the schools' subsystems function together (Supovitz *et al.*, 2010). Such a systemic approach of improving teaching and learning seems to provide principals a means of seeing the school as an integrated, complex composition of many interconnected components that need to work together, enabling principals to enact ST competencies.

Finally, the research findings showed that IL is positively related to PST, which, in turn, enhanced subject coordinators' job attitudes. These findings may be taken to support the idea that principals' IL may contribute to their ST, which may also be seen as a means for explaining and helping tap the benefits of IL. These results are particularly important, emphasizing the necessity of examining the antecedents and consequences of PST (Bui and Baruch, 2012; Senge, 2006), especially because most schools can still be described as loosely coupled organizations with little connection among teachers, who remain quite autonomous within their classroom (Weick, 2009). In this sense, research has recognized the contribution of

structural, cultural and leadership characteristics based on a more systemic approach for enhancing school faculty members' attitudes and interpersonal relationships (Anderson *et al.*, 2012). Yet, teachers and staff continue to work and learn primarily from individual and isolated experiences (Senge, 2012). These findings appear to emphasize the need for principals to enact ST activities in order to develop an organization's systems approach, expanding subject coordinators' perspectives to go beyond the immediate outcomes of their subject-matter to a broader perspective of the school system as an integrated whole.

Limitations and future studies

Several limitations of this study warrant further attention in future research. First, these self-reported data might be subject to bias and common method variance. Because the study sought to understand teachers' reactions to social context, self-reported data seemed to be the most appropriate for capturing employees' perceptions and appraisals of these variables (Fox and Spector, 1999). Our argument is consistent with the so-called Thomas Theorem (McCall, 2013), which asserts that individuals' perceived realities are indeed real for them, and so their consequences are real. Also, we have followed Podsakoff *et al.*'s (2003) recommendations to reduce common method variance. Yet, further research should use additional sources for evaluating subject coordinators' job attitudes. Second, the uniqueness of the sampled population and the fact that sample representativeness could not be ascertained restrict the ability to generalize the results, calling to explore the influence of PST as perceived by middle-leaders with different school functions, such as department heads or grade-level coordinators.

Third, the design of the present study does not permit direct evidence of causal links between IL, PST and subject coordinators' job attitudes. Conceivably, the causal order could be reversed. Nor can reciprocal causality be ruled out, making it impossible to determine whether IL causes PST, or whether PST causes subject coordinators to perceive their principals as instructional leaders. Similarly, we could not determine whether organizational commitment and job satisfaction cause PST, or whether PST causes subject coordinators to exhibit organizational commitment and job satisfaction. Therefore, future research would do well to use longitudinal designs to further validate the causal inferences suggested here.

Fourth, this study examined only selected antecedent and outcome variables. Organizational culture, for example, is another antecedent to ST (Alavi and McCormick, 2004). Further research should extend the inquiry to investigate the impact of culture regarding principals' tendencies to engage in ST activities. Moreover, future study could investigate the intervening role of job satisfaction on the relationship of PST to employees' work attitudes. Finally, researchers may wish to investigate PST's relations with other outcomes at both the team level (e.g. team effectiveness) and the organizational level (e.g. school violence, student academic achievements).

Implications

The present results may hold implications for policies involving the design and implementation of leadership tools and ST practices. Specifically, developing PST should be accompanied by development of a school-wide systemic approach. Toward this end, principals can design school practice fields, namely, fields of play, where they can construct virtual worlds for the sole use of experimentation. Although such a communal deliberative practice field resembles the real action domain, it facilitates consideration of how variables that exist in the system are causally related in feedback loops, as part of a circuit of cause-and-effect processes. Finally, as researchers have come to recognize subject coordinators as a key factor related to school functioning and improvement (Day *et al.*, 2016; Somech and Naamneh, 2019), expansion of subject coordinators' prism from one of only performing – overcoming daily (“real”) pedagogical problems – to one also entailing processes of rehearsing, experimenting and simulating may nurture a systemic outlook by future school leaders and subject coordinators alike.

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