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# Exploring the social ecological model based on national student achievements: extracting educational leaders' role

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## ABSTRACT

The purpose of this paper is to reexamine the effect of internal school factors such as school violence and class size, and external school factors such as family socio-economic resources on student math achievements, based on the social ecological model, eliciting an integrative approach. Data were collected from an Israeli national database, using average percentage scores for each school. The scores were based on results from 20,979 students in 191 junior high schools participating in the study. The study findings showed that in addition to low violence at school, family socio-economic status, including private math tutoring and computer-based math learning at home, predicted high math achievements. School violence partially mediated the relationship between sector and student achievements in math, while family socio-economic status partially mediated the relationship between district and student achievements in math. Our integrative model results may help school leaders to design policy to increase school effectiveness and reduce gaps among districts and sectors. The findings may encourage school leaders to strengthen the relations between schools and students' homes in order to influence students' activities there, especially in areas with low socio-economic status, to conduct school activities to reduce school violence, and increase computer-based learning in students' homes.

## Introduction

Over the past three decades, researchers have developed various models to understand the relationship between leadership and student achievements (e.g. Hamilton & Steele, 2013; Kythreotis, Pashiardis, & Kyriakides, 2010; Leo & Wickenberg, 2013). These studies have produced contradictory findings. While a few studies found some direct effects (e.g. Levine & Lezotte, 1990; Pashiardis, 2004), most studies found that the effects are indirect (e.g. Witziers, Bosker, & Krüger, 2003). Actually, research on the impact of school leadership has failed to provide conclusive answers to one of the key questions in the literature, regarding the role of school leaders in school effectiveness and school improvement. In this study, we focus on Israeli national assessments (*Meitzav*) in order to investigate factors that were found to be most important for the Israeli educational system and may explain students' math achievements.

This study's uniqueness is reflected by investigating students' perceptions based on the Social Ecological Model (SEM) relating to school leadership. Applying the SEM, we will suggest how educational leaders' role, both in schools and on the national level, may improve school effectiveness, reflected in this study by student math achievements. More specifically, while in the background there

is a debate concerning the dominant factors that contribute to students' achievements (external vs. internal school factors), the main goal of this study is to examine how the SEM that considers both internal school factors (e.g. student perceptions of school violence, class size) together with external school factors (e.g. family socio-economic resources, such as computer-based math learning at home and private math tutoring), and background factors (e.g. sector, district), may predict student math achievements. Based on the study results, we will elicit educational leaders' role in promoting student achievement.

While all over the world, based on educational leadership policy, a huge budget is dedicated to improve school internal resources, compared to a negligible budget dedicated to improving educational activities at home (e.g. Maxcy & Nguyen, 2013; Mestry, 2014), in this study we try to assume whether this kind of budget allocation would be the optimal way to improve learning and school effectiveness, as reflected for example by math achievements.

## Theoretical background

### *School effectiveness reflected by students' scores*

Inspired by international and national tests, the term *school effectiveness* refers to the impact of internal and external school factors on students' test scores. Concerning leadership, effective principals strive for a number of important student outcomes other than simply improved test scores (Leithwood, Harris, & Hopkins, 2008). However, because much of the policy and research focus is on estimating principals' impact on student test scores rather than on examining other factors (Scanlan, 2013), we decided to study school effectiveness by focusing on students' achievements, in the context of national tests and math achievements.

### *The SEM*

In this study, we will try to understand the role of educational leaders based on the potential dyad relations with the SEM with regard to students' achievements. The idea is that the role of educational leaders both shapes and is shaped by the SEM. Bronfenbrenner and Bronfenbrenner (2009) postulated that to understand human development, the entire ecological system needs to be considered. This system is composed of five socially organised subsystems that may affect the development of a variety of students. Each subsystem depends on the contextual nature of the student's life, offering a growing diversity of options. Within and between each subsystem, are bidirectional influences. These influences imply that relationships may impact in two directions, both away from and towards the student. Because school leaders potentially have access to these subsystems, we will try to clarify the influence between the role of educational leaders and the SEM. This investigation relates to how school principals and educational policy leaders may affect the different SEM subsystems in order to improve school effectiveness, and how these subsystems may affect the role of educational leaders.

The SEM includes the following subsystems (Bronfenbrenner, 2005): (1) *Individual* refers here to the students; (2) *Microsystem* refers to the layer closest to the student. This subsystem contains the structures within which the student has direct contact with his/her immediate surroundings, such as family (considering SES); (3) *Mesosystem (Interpersonal)* provides the relationship between the sub-systems of the student's world. For example, in this study the relationship between the student's principal and his/her parents; (4) *Exosystem (Organizational)* defines the larger social system (e.g. school). The structures in this layer impact the student's development by interacting with some structure in his/her microsystem; in this study we refer to school violence and class size; (5) *Macrosystem (Community)* is composed of cultural values, norms and laws, which in this study depend on sectors and districts; and (6) *Public policy*, which comprises policy and laws, referring in this study to educational systems that may have a cascading influence throughout the interactions of all other layers.

Based on the SEM approach, we will investigate a diagrammatic model (Figure 1) that emphasises the relationships between independent variables in the *micro-subsystem* such as: family socio-economic factors (external school factors, including computer based math learning at home and private math tutoring), in the *exo-subsystem* such as internal school factors (including school violence and class size), and students' math achievements (dependent variable). Based on Turner (1986), this diagrammatic model is designed to show how changes in the values of one set of variables are related to changes in the values of other variables, which may reveal activity among educational leaders.

### ***The elicited integrative model based on the relationship between external and internal school factors and students' achievements***

#### ***The relationship between school leadership and student achievements***

Previous studies examined whether and how school leadership affects student learning (e.g. Robinson, Lloyd, & Rowe, 2008). Empirical results across a large number of studies have begun to show consistent patterns of impact. 'Leadership for learning' describes approaches that school leaders employ to achieve important school outcomes, with a particular focus on student learning (MacBeath & Cheng, 2008).

In the earlier studies, researchers used models in which the relationship between leadership in schools and outcomes at the student level was conceived of as being a direct relationship (e.g. Hallinger, 2011). More recently, researchers have started to use mediated-effects models (e.g. ten Bruggencate, Luyten, Scheerens, & Slegers, 2012). Although considerable conceptual and methodological progress has been made, little is known about the paths through which school leaders can enhance student outcomes. Therefore, in this study based on the SEM, including external and internal school factors, we will try to find how educational leaders may promote student achievements.

#### ***External and internal school factors***

Previous studies have indicated that school effectiveness should be understood in terms of an integrative approach (Murphy, 2013). Various researchers have sought to identify the dominant factors affecting student achievements and in particular, the external or internal school factors involved (e.g. Dumay & Dupriez, 2007; Lee, 2002).

Regarding the influence of external factors on student achievements, Abbott and Fouts (2003) found that parental income predicts children's achievements. Supporting this approach, Chiu and Chow (2015) when controlling for country, family, school and student characteristics, found that

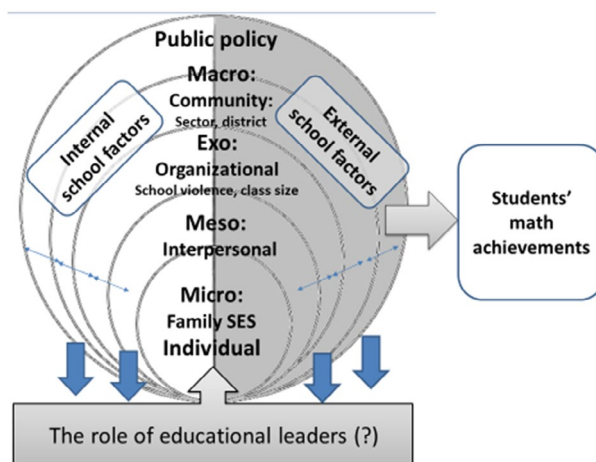


Figure 1. The study model.

classmates' family SES and educational resources at home were more strongly linked to student reading achievement than were classmates' attitudes toward reading.

Other studies claimed to find the exact opposite. For example, Cooper (2005) and Teddlie and Reynolds (2000) argued that internal school factors were more dominant than external factors in predicting student achievements. On the other hand, Coleman et al. (1966) argued that *external factors*, such as socio-economic background and parental involvement, and *internal factors*, such as the school's social fabric and its resources both predict student achievements, without preferring one or the other, whereas Dumay and Dupriez (2007) argued that neither external nor internal factors can strongly predict student achievements.

In the following section, we will expand on the relationship between these factors and students' achievements.

### *The relation between internal school factor (school violence, class size) and students' achievements*

**School violence.** Gumpel and Zohar (2002) argued that educational systems in Western countries, including Israel, face a difficult problem of violence. School violence ranges from verbal violence (e.g. humiliation, threatening), through physical violence (e.g. pushing, beating) to the use of weapons or other objects for threatening and attacking. Maring and Koblinsky (2013) found that the ecological theory provides a valuable framework for organising and interpreting teachers' responses within multiple systems of influence, as well as identifying levels for potential intervention. In their study, they found that middle school teachers expressed challenges at various levels of the ecological framework.

*On the individual level*, Maring and Koblinsky (2013) also reported a lack of training needed to manage students' behaviour, enforce school rules and introduce social skills curricula in their classrooms. This lack of training likely contributed to two additional individual-level challenges: fears for personal safety and somatic stress symptoms. Some teachers acknowledged that such fears and stress symptoms threatened their instructional effectiveness.

*On the school level*, many teachers reported being challenged by safety and security concerns. In Bosworth, Ford, and Hernandaz (2011), school climate was critical in perceptions of safety, with teachers feeling challenged by inadequate school discipline, ambiguous rules and enforcement policies. Research reveals that the ways in which schools enforce behavioural rules and handle student aggression have a significant impact on students' and teachers' perceptions of safety (Limbos & Casteel, 2008). It was found that school leadership plays a key role in ensuring that school rules and policies are clear, widely communicated and consistently applied. When such leadership is absent, teachers' ability to focus on academics and student support is likely to be compromised.

*On the community level*, most teachers articulated the challenge of teaching in schools located in violent neighbourhoods. Teachers were not only affected by reports of local crime but also by the number of their students who witnessed or were victims of violent acts. As in prior research (Sela-Shayovitz, 2009) they interacted with students who brought aggressive, antisocial behaviours into the classroom, as well as students affected by grief and trauma.

Marlatt, Larimer, and Witkiewitz (2011) provided important insights about the coping strategies that school teachers adopt in schools affected by community violence: positive thinking, behavioural control, family support, family communication, belongingness and sense of community connectedness. On the community level, teachers had little involvement with community-based initiatives to reduce violence. In particular, teachers suggested programmes to enhance parents' supervision skills and their ability to help children navigate dangerous environments. Podorefsky, McDonald-Dowdell, and Beardslee (2001) found that parenting education may enhance parents' ability to rear their children in violent settings. Strengthening parental involvement may also help to ensure that students receive consistent safety messages at home and at school, an important element of effective violence prevention programs.

Data gathered from TIMSS tests in 37 countries indicated that roughly one in four students reported a fear of falling victim to violence at school (Akiba, LeTendre, Baker, & Goesling, 2002). In a study among 8th graders in 33 countries, Bowen and Bowen (1999) found that student fears of falling victim to violence affected their attendance at school, their motivation to learn and their academic achievements. Hence, they concluded that principals and teachers should strive to create a safe physical and psychological environment for students.

Benbenishty and Astor (2005) showed that *school violence derives from disciplinary problems* and disobeying school regulations. Therefore, it seems that by more carefully controlling student discipline, school principals can provide a safer environment (Higgins, Ishimaru, Holcombe, & Fowler, 2012).

Shavit and Blank (2011), based on TIMSS questionnaires completed by principals, teachers and students to measure school discipline, found that student discipline in Israel was lower than in Japan, the Netherlands, Russia, USA, Canada, South Korea, Chile and Italy. Their analyses focus on *school principals'* questionnaires asking to report on various aspects of discipline at their respective schools, including the frequency of students' late arrivals, students' full day absences, and skipped classes. 'Disciplinary infraction' scores were given on the basis of these reports. *Teachers* were asked to report the frequency of classroom disruptions that interfere with their ability to teach. *Students* were asked to answer a series of questions designed to reveal to what extent they had been victimised by violence in the preceding month (e.g. whether anything was stolen from them, whether they were assaulted). High scores on the above measures represented poor discipline and high victimisation levels. In another study of 4318 Israeli 8th grade students, Shavit and Blank (2010) found that student discipline is positively related to student achievements.

A study by Dinkes, Cataldi, and Lin-Kelly (2007) indicates that school violence – characterised by teacher violence against students, student involvement in violent incidents and the lack of a feeling of security among students – is detrimental to school effectiveness. This finding was supported by another study (Gottfredson et al., 2000), which found that violence and disciplinary problems in the classroom reduce learning time for all students in the class, and thus impair school effectiveness and student achievements.

### **Class size**

According to Blass (2008), the main explanation for the relationship between class size (the number of students per class) and academic achievements is that in larger classes, teachers are more limited in their ability to devote individual attention to students. This argument was supported by Krueger (2003), who found that all students who studied in smaller classes improved their academic achievements, but the greatest and most significant advances were found among students from lower SE backgrounds.

Finn, Pannozzo, and Achilles (2003) argued that a smaller class framework allows students to be more active both academically and socially. According to these researchers, academic and social involvement, in turn lead to both improved achievements and a more positive attitude towards learning. Teachers can play a central role in getting students involved in learning. A more 'laid-back' teacher interaction with students, together with a greater focus on learning, can help get students involved in learning.

Based on the theoretical background above, we may assume that:

#### *Hypothesis 1.*

Considering school internal factors:

- a. Student perceptions of the extent of *violence at their school* will be negatively related to their achievements in math.
- b. *Class size* will explain students' achievements in math.



### *The relations between family socio-economic resources (external school factors) and students' achievements*

Previous studies indicated that students with higher SES have higher academic achievement (e.g. Walker, Petrill, & Plomin, 2005). Families can use their financial, human, social and cultural capital to give their children learning opportunities (Chiu, 2013). Specifically, families with more money (financial capital) can buy more educational resources (advanced computer at home, private tutoring) to create a richer learning environment (Chiu, 2010). Families with more education, knowledge and skills (human capital) often create better learning environments for their children, and teach them more skills than other families can (Davalos, Chavez, & Guardiola, 2005). In short, high SES students have more financial, human, social or cultural capital. Using their greater capital, higher SES students can better understand others' expectations, behave properly at school, have closer relationships with teachers and classmates, and learn more in school than do lower SES students (Chiu & Chow, 2015).

### *Expanding computer-based learning at students' homes*

There are four elements in the *pedagogical core* of innovative learning environments: learners, teachers, content and resources. However, the learning environment cannot be understood as a purely pedagogic core. Since a student's environment is shaped over time, it depends critically on the capacity for leadership to design and shape their learning (OECD, 2012). According to the *leadership design/redesign circle*, the powerful twenty-first century learning environment will be driven by strong visions of learning objectives and strategy with distributed, focused leadership. It will be information-rich about the learning taking place, and the information will feed revised strategies for learning and further innovation (Dumont, Istance, & Benavides, 2010).

Traditionally, schools have tended to be closed. The contemporary learning environment will instead have well-developed connections with other partners, named *the partnership circle*, which will extend the environment's resources and learning spaces. Such extensions represent another wider circle, bringing in, at the least, local communities (including families); partnerships with businesses, cultural institutions, or higher education; and connections with other schools and learning environments through networks. They impact the pedagogic core by widening the resources, content, expertise, and learning dynamics, while often contributing to the learning leadership that is integral to the second *leadership design/redesign circle* (Istance & Kools, 2013).

A study by Jones and O'Shea (2004) contended that recent years have seen an increasing application of technology for learning purposes inside and outside schools, mainly in students' homes. Inglis, Ling, and Joosten (2002) claimed that great effort is invested in building a computer-based learning environment. A study conducted by Douglas and Sousan (2002) among students aged 12–18 in 36 schools in the U.S., suggests that personal learning at home, such as using the internet, offers students several advantages, making learning deeper and more efficient.

These advantages are due, *inter alia*, to the communication possibilities inherent in the internet, which allow an exchange of ideas and materials. This study also indicates that teachers have also found electronic media (including the school forum, email) to be an extremely efficient medium for transmitting sources of knowledge. In addition, Muir-Herzing (2004) confirmed that computer-based learning in students' homes as well promotes interaction between students outside school and motivates them to learn, expands their horizons and improves their academic achievements.

### *Private tutoring*

Private tutoring (PT) in academic subjects beyond the hours of formal education has taken hold in many parts of the world after a rapid growth over the past few decades (Mori & Baker, 2010). Private supplementary tutoring is widely known as shadow education (e.g. Buchmann, Condron, & Roscigno, 2010; Zhang, 2014). The 'shadow' curriculum mimics the curriculum within the schools, and changes according to adjustments to the latter. PT cannot be ignored by researchers, educators and policy makers, as it has become a worldwide phenomenon that occurs in East, West and Central Asia, Europe, North America and in Africa (Bray & Lykins, 2012), and characterises both developed

(e.g. US, Canada, France and Japan) and developing countries (e.g. Kenya or Togo and Tanzania) (Barrow & Lochan, 2012).

PT is regarded as a social issue that transcends individual concerns and seeks to look at broad social, political, cultural or organisational factors, as concluded by several researchers (e.g. Bray, Mazawi, & Sultana, 2013). In this context, PT may be viewed as an *enrichment strategy* that turns out to be a part of children's education, life's routine and culture (for example in Japan or South-Korea, France) that enables gaining an advantage in the competition over future education (e.g. Ireson & Rushforth, 2014). This is particularly so among affluent families who are able to purchase more and higher quality PT than less prosperous families (Bray & Lykins, 2012). Participation in PT can also be regarded as a *compensatory strategy* in order to respond to low school quality and concerns about the educational services their children receive at school.

Tutoring for them is a likely part of a larger complex of parenting practices that, through their intervention and use of structured activities, boost their children's 'home advantage'. Consequently, for high SES students, participating in PT turns out to be an integral part of students' leisure time and lifestyle that reflect their cultural capital (Bray, 2011), their conformity to norms of competitiveness and pressure to excel.

Lareau (2013) indicated that in the US when choosing school *districts*, parents based their decision mainly on selecting areas of residence whose population is similar to them. The result of this process is that the middle-class and upper-middle class are situated in homogeneous neighbourhoods, and thus benefit from socially segregated schools in which students and their parents share a similar culture and norms. Indeed, given trends of residential and accordingly school segregation as it occurs in the US and other countries (Blase, Zusman, & Tzur, 2014), a high concentration of students from a high SES background can have implications for PT intensity at school.

Mischo and Haag (2002) argued that the rising number of students relying on private tutors might be due to the formal educational system's inability to satisfy cognitive, emotional and motivational needs. They pointed out that 23% of Luxembourg students study with private tutors in math, and show signs of progress in achievements at school, presumably because the PT improves their cognitive and motivational abilities in a way schools cannot. According to Dang and Rogers (2008) about 25% of students worldwide report using PT. However, tutoring is treated differently by policy-makers in each country. Some countries ignore it altogether, while others try to regulate it, out of a concern for reducing social inequalities. While it has been shown that private tutoring is extremely efficacious in improving short term learning achievements in math, one drawback is that it increases educational inequalities between weaker and stronger students (Hof, 2002)

Based on the theoretical background above, we may assume that:

*Hypothesis 2.* The extent of family SE factors will be positively related to achievements in math.

### ***The relations between background factors (district, sector) and student achievements***

Richer districts and sectors often have more public resources that can improve student achievement. Wealthier districts and sectors often provide more public resources such as public libraries or better education (e.g. certified teachers; Baker, Goesling, & LeTendre, 2002). Students in these districts and sectors often capitalise on these opportunities to learn more. Thus, the distribution of resources within a country (between districts and sectors) might affect student achievement. Greater household income inequality within a country (among sectors and districts) might reduce student achievement through diminishing marginal returns or homophylic bias.

### ***District (center/periphery)***

The Central Bureau of Statistics (2011) divides the State of Israel into seven administrative districts. Generally speaking, geographic location has socio-economic and cultural implications. According to Lavi (2013), unemployment stood at 6.2% in the North and South districts (located at Israel's periphery), compared to just 2.5% in the Central districts. It seems that the roots of the vast gaps in employment can be traced to the levels of student education in the different districts. In the peripheral districts, 54% of students were eligible for a high school matriculation certificate, including studies



on a higher learning level in subjects such as Math, English, Physics, Biology, Chemistry (These subjects can be studied at different levels, for example, 3 points, which is considered a low level, 4 points, considered a medium level, and 5 points, considered a high level) compared with 65% in the Central districts. Similar gaps can be found in the percentage of students eligible for university admittance.

These statistics reveal a positive link between a student's SE background and the likelihood of graduating high school and being admitted to higher education. Similarly, the higher the student's SE background, the higher his or her educational achievements. A review of municipal investment in education paints a grim picture of the state of education in the peripheral districts. Central municipalities invest 30% more than northern municipalities in education. Growing expenditures for PT and parents' school fees have also contributed to making public education less accessible to parents and have increased inequality.

### *Sector (Hebrew-speaking/Arabic-speaking)*

According to Abu-Asbah (2007), the gaps between the educational systems in the two sectors (Hebrew-speaking/Arabic-speaking) stem in part from unequal allocation of budgets between the two sectors. The differences can be seen in the shortage of resources (e.g. buildings, classrooms, laboratories) in the Arabic-speaking sector. A comparative view of educational inputs shows that the Arabic-speaking population receives fewer resources than the Hebrew-speaking population. Thus, for instance, the number of students per class is greater in the Arabic-speaking sector, the number of weekly hours per student is smaller, and the teachers' academic level is lower. A comparison of national *Meitzav* exam results, taken during the 2007–2008 school year among Arabic-speaking and Hebrew-speaking 5th–8th grade students, shows that Arabic-speaking students score significantly lower than Jews (Israeli Ministry of Education, 2014). These measures reflect the relation between school sector and its educational achievements, and reveal a significant advantage for the Hebrew-speaking side (Zuzovsky, 2008).

Based on the above theoretical background, we may assume that:

*Hypothesis 3.* Background factors (sector, district) will explain students' achievements in math.

Figure 1 illustrates the study's basic model, which examines whether the following factors: school violence and class size (internal factors, belong to the exo-subsystem), computer-based math learning at home, private math tutoring (external factors, belonging to the micro-subsystem), sector, district (background factors, belonging to the macro subsystems) can explain achievements in math.

### *The Israeli context*

Israel's educational system is a centralised system, which determines the scholastic programme for each subject and its appropriate standards (Nir, Ben-David, Bogler, & Zohar, 2016). This system relies on extensive external assessments through national exams, including *Meitzav* exams (measuring school efficiency and growth) and *Bagrut* (high school matriculation) exams, as well as international tests such as TIMSS and PISA. In the State of Israel, the RAMA agency (a national agency for measurement and assessment) has adopted the standards set by the international OECD countries. It distributes climate and pedagogic environment questionnaires to each school in Israel. The *Meitzav* tests use learning materials derived from international assessments to study the different leadership strategies through which schools may be improved.

The present study is based on questionnaires distributed to students. *Meitzav* scores for all Israeli schools are published on the Ministry of Education's website, under the heading 'Almost Everything About Education' ([www.education.gov.il](http://www.education.gov.il)).

## **Method**

### *Population sample*

The present study was conducted in Israel among 8th grade students. The schools that were examined belonged to two main sectors: Hebrew-speaking and Arabic-speaking. The schools

surveyed represent proportionally the different geographic regions in Israel. The sample included 191 junior high schools and 20,979 students. Of the schools, 138 belong to the Hebrew-speaking and 53 to the Arabic-speaking sectors; 78 from Central districts and 113 from the other districts.

### The study procedure

Each 8th grader completed a questionnaire as well as a math exam. The integral *Meitzav* exam probes how students perceive a wide range of topics drawn from daily school life. Its purpose is to provide school principals and Ministry of Education officials with a diverse and comprehensive picture that can help them identify the relative strengths and weaknesses of each school in particular, and of the system as a whole. It focuses on specific parameters that interest the Ministry of Education, and curriculum changes over time. The questionnaires, completed anonymously by students, were about issues such as students' sense of security at school; the use of computer-based learning methods for studying math; and the use of private tutoring (answers were ranked on a five-point Likert scale, ranging from 'Never' (1) to 'Very often' (5)). However, the *Meitzav* reports only on the percentage of students who marked 4 or 5 (high level of agreement to the *Meitzav* items). Thus, our analysis was based on the *level* (0–100%) of each school average percentage of students who marked 4 or 5. The math exam in particular gauges students' grasp of topics from the new math program, focusing on subjects studied in 8th grade.

### Analytical approach

The data in the Ministry of Education's website include only *a single average score for each item for each school* (rather than an average score for each student in the school), based on results from the students' questionnaires. Therefore, the data are by nature not multilevel, so that only factor analyses, correlations, regressions, and Structural Equation Modelling analyses are appropriate for this data.

### Results

In analysing our data, we found that the items appearing in the students' questionnaires could be divided into two main factors, which elicited the SEM's internal school factor (related to the exo-subsystem, organisational layer), and its external school factor (related to family SES, belonging to the micro-subsystem (Table 1).

We found that *school violence* (the internal school factor) was characterised by two aspects of: student security vis-à-vis classmates, including physical and/or verbal violence; and student security vis-à-vis teachers, including physical and/or verbal violence (4 items,  $\alpha = .76$ ). In addition, one *external school factor* was found, including aspects such as assisting students in math through private math tutoring and through computer-based math learning at home (2 items,  $\alpha = .73$ ).

**Table 1.** Factor analysis results.

Items	Exo-subsystem: Internal school factor: School violence	Micro-subsystem: External school factors (family socio-economic resources)
Teachers' verbal violence towards students	.56	.01
Teachers' physical violence towards students	.85	-.17
Lack of a sense of security by students	.84	.04
Student involvement in violent incidents	.83	-.10
Computer-based math learning at home	-.07	.84
Taking private math tutoring	-.13	.75

Table 2 displays the correlations found for the study variables.

Table 2 shows that a high proportion of Arabic-speakers are located in peripheral districts ( $r = .31$ ,  $p < .01$ ). In addition, a relatively high level of school violence was noted in schools in the Arabic-speaking in comparison to the Hebrew-speaking sector ( $r = .22$ ,  $p < .01$ ). In order to verify these findings, using a  $T$  test (Table 3) we found that school violence was significantly higher in the Arabic-speaking sector ( $M = 16.24$ ,  $SD = 6.50$ ) in comparison to the Hebrew-speaking sector ( $M = 13.34$ ,  $SD = 5.70$ ), ( $t(166) = -2.40$ ,  $p < .05$ ).

In addition (Table 2), math achievements tended to be higher in the Hebrew-speaking sector than in the Arabic-speaking sector ( $r = -.35$ ,  $p < .01$ ).

**Table 2.** Study variables correlations.

		2	3	4	5	6
1	School violence	.22**	.11	-.16*	.03	-.32**
2	Sector		.31**	-.18*	.08	-.35**
3	District			-.32**	.02	-.31**
4	External school factors (family socio-economic resources)				.36**	.40**
5	Class size					.10
6	Math achievements					

Notes: Sector: 1 = Hebrew-speaking; 2 = Arabic-speaking; District: 1 = Centre; 2 = Periphery.

\* $p < .5$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Based on a  $T$  test (Table 3), we found math scores to be significantly higher in the Hebrew-speaking sector ( $M = 53.79$ ,  $SD = 14.90$ ) in comparison to the Arabic-speaking sector ( $M = 44.68$ ,  $SD = 11.72$ ), ( $t(166) = 3.05$ ,  $p < .05$ ).

External school factors (private math tutoring, and use of computer-based math learning) were found to be lower in peripheral districts in comparison to central districts ( $r = -.32$ ,  $p < .001$ ). Based on a  $T$  test (Table 3), we found that external school factors were significantly higher in central districts ( $M = 29.97$ ,  $SD = 10.02$ ) in comparison to peripheral districts ( $M = 23.41$ ,  $SD = 9.45$ ), ( $t(189) = 4.59$ ,  $p < .001$ ). In other words, students studying in peripheral districts tended to use private math tutors and computer-based math learning less often.

Furthermore, math scores tend to be higher in the central districts than in other districts ( $r = -.31$ ,  $p < .01$ ). Based on a  $T$  test (Table 3), we found that math scores were significantly higher in central districts ( $M = 56.29$ ,  $SD = 15.47$ ) in comparison to peripheral districts ( $M = 46.73$ ,  $SD = 11.39$ ), ( $t(189) = 4.55$ ,  $p < .001$ ).

**Table 3.**  $T$ -test for independent samples.

	<i>N</i>	<i>M</i> ( <i>SD</i> ) Stand- ardised math achievements	<i>t</i>	<i>M</i> ( <i>SD</i> ) School violence	<i>t</i>	<i>M</i> ( <i>SD</i> ) External school factors (family socioeco- nomic factors)	<i>t</i>	<i>df</i>
Sector								166
Hebrew-speaking sector	140	53.79 (14.90)	3.05*	13.34 (5.70)	-2.40*	27.18 (10.38)	.49	
Arabic-speaking sector	28	44.68 (11.72)		16.24 (6.50)		26.14 (9.11)		
District								189
Centre	78	56.29 (15.47)	4.55***	13.31 (6.08)	-1.57	29.97 (10.02)	4.59***	
Periphery	113	46.73 (11.39)		14.74 (6.29)		23.41 (9.45)		

Notes: Sector: 1 = Hebrew-speaking; 2 = Arabic-speaking; District: 1 = Centre; 2 = Periphery.

\* $p < .5$ ; \*\*\* $p < .001$ .

A negative relationship was found between school violence and math students' achievements ( $r = -.32, p < .01$ ) (Table 2), and a positive relationship between the external factors (computer based math learning at home and private math tutoring) and math students' achievements ( $r = .40, p < .01$ ). However, no relation was found between class size and academic achievements. By contrast, a positive relationship was found between external school factors and class size ( $r = .36, p < .01$ ).

### Regression analysis findings

A stepwise regression (Table 4) showed that four measures are linked to math scores: external school factors, school violence, sector and district. The regression analysis shows that high external variables, such as using private math tutoring and using computer-based math learning at home, predict high levels of math achievement ( $\beta = .25, p < .001$ ), while high levels of school violence predict low levels of math achievement ( $\beta = -.21, p < .001$ ). In addition, belonging to the Hebrew-speaking sector predicts a high level of math achievement ( $\beta = -.21, p < .01$ ), while belonging to peripheral districts predicts low levels of math achievement ( $\beta = -.15, p < .05$ ). The regression findings indicate that class size did not predict students' achievements.

**Table 4.** Stepwise regression analysis for predicting math achievements.

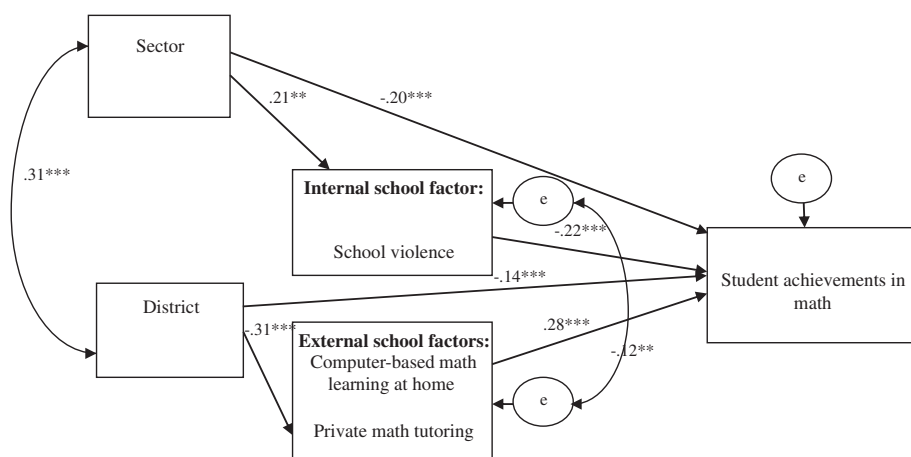
SE		$\beta$	Variables	Step
1	Sector	-.35***		2.31
2	Sector	-.28***		2.36
	District	-.23**		2.13
3	Sector	-.27***		33.2
	District	-.23**		2.10
	Class size	.16		.01
4	Sector	-.25***		2.25
	School external factors	.28***		.10
	District	-.15*		2.12
	Class size	.08		01.
5	School external factors	.25***		.10
	School violence	-.21***		.15
	Sector	-.21**		2.23
	District	-.15*		2.06
	Class size	.08		.01

Notes: Sector: 1 = Hebrew-speaking; 2 = Arabic-speaking; District: 1 = Centre; 2 = Periphery.

\* $p < .5$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ;  $R^2 = 29.5\%$ .

### Additional results

In this study, Structural Equation Modelling analysis was conducted using the Amos software, which is based on a structural equations system, and is used to present graphic models of relations (both correlative and regressive) between variables (both observed and latent) (Blunch, 2008). After studying the strength of the relations between the model variables, and reviewing the Goodness of Fit Index (GFI), we arrived at the model which appears as Figure 2. A majority of scholars, such as Hu and Bentler (1999) and Chen, Curran, Bollen, Kirby, and Paxton (2008) concluded independently that it was necessary to use several GFI in order to reduce the rate of errors in the proposed model. Therefore, after reviewing several GFI, we found the following indexes to be adequate:  $X^2 = 2.044$ ,  $df = 2$ ,  $P = .360$ ,  $RMSEA = .011$ ,  $NFI = .983$ ,  $CFI = .920$ ,  $TLI = .905$ ,  $SRMR = .056$ . We used the following useful rules of thumb: (a) The smaller the chi-square, the better the model's fit; (b) An indication of a good fit for RMSEA is a value of .05 or less (.0 indicates an exact fit); (c) A TLI of  $\geq .9$  indicates an acceptable model fit; (d) a CFI  $> .90$  indicates a good fit; and (e) an SRMR value of less than .08 is considered a good fit, with smaller values tending toward a better fit (Hu & Bentler, 1999).



$$X^2=2.044, df=2, P=.360, RMSEA=.011, NFI=.983, CFI=.920, TLI=.905, SRMR=.056$$

$$p < 0.5^*, p < 0.01^{**}, p < 0.001$$

Sector: 1= Hebrew-speaking, 2= Arabic-speaking; District: 1=Center, 2=Periphery

**Figure 2.** The study findings model.

Notes:  $X^2=2.044, df=2, p=.360, RMSEA=.011, NFI=.983, CFI=.920, TLI=.905, SRMR=.056$ . Sector: 1= Hebrew-speaking, 2= Arabic-speaking; District: 1= Centre, 2= Periphery.  $*p < .5$ ;  $**p < .01$ ;  $p < .001$ .

We examined most of the hypotheses according to the resulting model. Hypothesis (1) was partially supported, a negative relation between school violence and achievements in math, was confirmed ( $\beta = -.22, p < .001$ ). However, no relation was found between class size and academic achievements (based on pre-analyses appearing in Tables 2 and 4, explaining the fact that class size was omitted while studying the strength of the relations between the model variables, and reviewing the GFI until arriving at the final model).

Hypothesis (2), which claimed that a positive relation would be found between family socio-economic resources (external school factors) and math achievements was also confirmed ( $\beta = .28, p < .001$ ). Hypothesis (3), which claimed that background factors (sector, district) would predict students' achievements in math, was supported. We found that sector ( $\beta = -.20, p < .001$ ) and district ( $\beta = -.14, p < .001$ ) predict students' achievements in math, while belonging to the Hebrew-speaking sector and to the central districts predicts a higher level of math achievement.

In addition, using the Sobel test (Table 5), we found that school violence partially mediated the relationship between school sector and student achievement in math. We found a significant relationship between school sector and student achievement in math ( $\beta = -.36, p < .01$ ). After adding the mediator of school violence, the relationship value was reduced, but still significant ( $\beta = -.30, p < .01$ ). The .06 reduction was found significant according to the Sobel test ( $Z = -2.42, p < .01$ ). Because the indirect relationship was found to remain significant, we may conclude that we found partial mediation.

Similarly, we found that external school factors (computer-based math learning at home and private math tutoring) partially mediate the relationship between school district and school achievement in math. We found a significant relationship between school district and student achievement in math ( $\beta = -.31, p < .01$ ). After adding the mediator of external school factors, the relationship value was reduced, but still significant ( $\beta = -.21, p < .01$ ). The .10 reduction was found to be significant according to the Sobel test ( $Z = -3.32, p < .01$ ). Because the indirect relationship was still found significant, we may conclude that we found partial mediation.

**Table 5.** Testing mediating effects with the Sobel test.

IV	MED	DV	Direct effect ( $\beta$ )	Indirect effect ( $\beta$ )	Z (Sobel test)	The mediating effect (in absolute value)
Sector	School violence	Achievements	-.36**	-.30**	-2.42**	.06
District	External school factors	Achievements	-.31**	-.21**	-3.32**	.10

\* $p < .5$ ; \*\* $p < .01$ .

Regarding the mediating effects (Figure 2), we found that belonging to the Arabic-speaking sector predicts a higher level of school violence ( $\beta = .21, p < .01$ ), which may be related to lower achievements in math ( $\beta = -.22, p < .001$ ). We also found that belonging to central districts predicts a higher level of computer-based math learning at home and private math tutoring ( $\beta = -.31, p < .001$ ), which may improve students' achievements in math ( $\beta = .28, p < .001$ ).

## Discussion

Previous studies support the existence of core leadership practices for improving student achievements (e.g. Jacobson, 2011), and reveal that in addition to the leadership practices, another necessary prerequisite for successful schools is improving the learning environment, based on students' and teachers' perceptions of physical safety. Prior research, as far back as the Coleman Report (Coleman et al., 1966), as well as evidence from ISSPP (The International Successful School Principalship Project) cases (Jacobson, 2011), suggest that certain demographic and personal characteristics, such as student background factors and SE status, or organisational characteristics, such as location (e.g. rural, sub-urban, urban) and class size (number of students), may affect a school's success in improving student achievement. However, the evidence available does not yet allow us to feel confident about asserting claims with regard to these factors.

Therefore, drawing on results of Israeli national assessments, the present study uses the SEM, an integrative model, to test whether internal factors such as school violence, and external school factors such as private math tutoring and using computer-based math learning at home, can predict a student's achievements in math. We found that in 2016 external and background factors still played an important role in the SEM model, in addition to internal school factors. For example, we found that school violence partially mediated the relationship between sector and students' achievements in math, while external school factors such as family SES factors (using computer at home and employing private math tutors) partially mediated the relationship between district and students' achievements in math.

The findings regarding school violence may support previous studies indicating that principals who led effective schools worked tenaciously to create safe and orderly learning environments (e.g. Jacobson, 2011). Similarly, the findings regarding computer-based learning at home and PT may support part of Coleman et al.'s findings (1966), indicating that out-of-school factors such as family background and socio-economic status may explain student performance in addition to internal school factors.

In general, we may say that our elicited model concurs with previous studies (e.g. Akiba et al., 2002; Dumay & Dupriez, 2007; Yoshino, 2012) which suggested that school leaders should use an integrative approach to find factors predictive of school achievements. This is so because it is the predictive factors themselves, when integrating internal and external school factors, that explain students' achievements, making it less important for our purposes to isolate any single factor that contributes more than another.

The present study paints a difficult picture regarding the gap between sectors and districts in Israel that may affect school violence, computer-based learning at home, private tutoring and students' achievements. For example, the findings that school violence partially mediates the relationship between school sector and student math achievements may be explained by the fact that since the Arabic-speaking sector is characterised by low resources, it suffers from larger classes and less human resources such as teachers and school counsellors, which may increase school violence and reduce achievements. This may be explained by the fact that teachers dedicate a large part of their time to



dealing with violence problems instead of teaching. In addition, the violent atmosphere at school makes it difficult for students to study well. These findings may be supported by previous studies indicating that improving the learning environment, including ensuring that it is physically safe, is a necessary prerequisite for successful school initiatives in challenging environments, particularly those with low educational resources (e.g. MacNeil, Prater, & Busch, 2009).

Furthermore, the finding that external school factors (family socio-economic resources: computer-based math learning at home, private tutoring) partially mediate the relationship between school district and student math achievements may be explained by the fact that there are less resources per student in peripheral sectors than in the centre of Israel, and therefore, peripheral district students use less computers for learning at home and PT, which may affect their math achievements. These findings support previous researchers' findings about the potentially constructive roles of school districts in enhancing learning and school effectiveness (Togneri & Anderson, 2003; Trujillo, 2013).

We found that school violence can explain low achievements in math quite well. This finding can perhaps be explained by the fact that schools characterised by violence are often also characterised by a lack of classroom discipline (Shavit & Blank, 2010). Lack of discipline, in turn, distracts students who would otherwise be more attentive, and prevents the teacher from effectively teaching the material.

The present study's findings support an argument made by Mistler-Jackson and Songer (2000) to the effect that computer-based learning in the student's home provides more interactions of effective learning. The capacity for interactive collaboration from students' homes also allows them to actively participate in both personal and group learning, independent of their SE neighbourhood status. In addition, a learning environment which integrates computers into the learning process in students' homes can allow a teacher to diversify his or her modes of operation, improve interaction patterns with students and pay more attention to the differences between students.

The high predictive ability of PT can be explained by the way a private tutor is able to give individual attention to his student. PT usually takes place in the student's or tutor's home, free of the usual classroom distractions. The result is a student who is more ready for quality and meaningful study. Moreover, during a private lesson a student can ask specific questions about the material or raise particular difficulties. These advantages all contribute to improving a student's ability and achievements in the subject studied. However, it is important to mention that private tutoring presupposes a middle class or higher socio-economic status, a fact that may support our findings that in Israel's central districts, which are considered wealthier than peripheral districts, there is a greater tendency to take private lessons than in the periphery.

In any case, the findings that in large classes, students tend to make greater use of home computers for learning and to take more private tutoring, may be explained by the fact that learning in larger classes is difficult, and students therefore try to reduce their learning gaps with computer-based learning or by taking private tutoring. The high achievements of the central districts may be explained by the fact that greater achievements in math in the central districts may reflect the greater wealth of the municipalities, which can invest more in education.

The present study findings are in accordance with prior findings showing that schools in large cities are inclined to place greater emphasis on academic achievement and educational success. In such a context, students' desire to receive PT may increase (Song, Park, & Sang, 2013). Our findings can be supported by Addi-Raccah and Dana's (2015) study indicating that PT is an additional mechanism for the socially advantaged groups that are concentrated in a particular school setting.

As found in high SES schools with high achievements, located in the centre and serving a Hebrew-speaking secular population, many students participate in PT, probably as part of the enrichment strategy. In this regard, the findings confirm the argument that PT amplifies processes of social inequality and social reproduction. PT thus reinforces the establishment of distinct and privileged school settings (i.e. high SES and high achievements), which are also located geographically in the centre of the country.

While Addi-Racah and Dana (2015) found that Arabic-speaking elementary schools are similar to Hebrew-speaking elementary secular schools regarding the amount of PT used, in the present study we also did not find a significant difference among middle schools. However, we still found gaps between achievements in math in the Hebrew-speaking and Arabic-speaking sectors (achievements in the Hebrew-speaking sector are higher than in the Arabic-speaking sector), which can be explained by the differing resource allocation in favour of the Hebrew-speaking sector.

In summary, the relationship between what occurs in and out of school is becoming stronger, indicating that this issue cannot be ignored in policy-making. It seems that educational leaders on the school level and the national level should consider the suggested integrative model based on SEM, while taking into account the country's cultural context, and then develop suitable leadership strategies in order to reduce gaps and increase student achievements by investigating not only within schools, but also students' home education.

## Conclusions

Until the present, there has been a debate about what affects students' achievements more, internal or external school factors. While this study focused on math achievements, we believe that our findings may be relevant to other subjects, based on previous studies indicating that the SEM may affect students' achievements in general (Chiu & Chow, 2015; Shymansky, Wang, Annetta, Everett, & Yore, 2013). This SEM based study establishes that both factors are important, whereas school principals and educational policy leadership tend to investigate within schools more than examine students' home educational process. The findings encourage school leaders at any level to invest more in students' home educational process, such as providing Laptops and Tablets to students, particularly from low SES, in order to continue their learning process and interactions at home, or sponsoring private tutors in students' homes, especially for low SES families, in order to promote students' achievements.

The issue of PT in schools needs to be studied further with regard to countries that lack a policy on this matter. This is especially important when we consider the study's findings that PT contributes to higher achievements in math. Thus, educational leaders from all levels should consider allocating resources differently, for example, by investing more in individual learning hours (between teachers and students) at schools and students' homes, which may reduce parents' expenses for PT, and may increase equal opportunities among students.

Moreover, using an integrative approach based on SEM, we found that school violence is negatively related to achievement. Thus, it is important to initiate leadership activities in schools that will deal with violence and its prevention. Violence can be found among all sectors and districts in Israel and outside of Israel, and dealing with it should be a national priority.

Finally, regarding the findings that the number of students per 8th grade class did not predict students' math achievements, in future studies we may investigate the advantages of small classes. In addition, future studies may investigate whether we may generalise these findings to other grades and to subject fields other than math, within Israel and abroad.

In any case, it seems that the results may influence national policy and school principals' initiatives to increase school effectiveness, as reflected by student achievements. Since each country has a unique educational system, and its principals, teachers and students behave differently under certain circumstances, future studies should also consider the country's culture and its effect on students' math achievements and on other subject fields.

## Contribution and extracting educational leaders' role

This study focuses on SEM in the context of students' achievements, largely ignored in international educational leadership studies. By adding SEM to educational leadership research, we elicited the role of the educational leader in order to improve students' achievements, by explaining the inter-relationship between school violence (belong to the exo-subsystem of SEM), external school factors

and background variables (belonging to the micro and macro-subsystems of SEM) on the one hand, and student achievements on the other.

Practically, the findings may help educational leaders to design educational policy and training programmes for school principals. These policies and programmes may promote academic achievement among students, as well as helping to identify the appropriate ways to prepare school principals to develop leadership practices that suit the different contexts in which they find themselves. For example, on the *school level*, it emphasises strengthening the relation between the student and his/her teachers by conducting school activities and teachers' development programmes, focusing on team-based simulations, and considering critical incidents in students' violence, such as verbal, mental and physical violence. Practicing how to reduce student violence may create a climate that increases students' achievements as described in previous studies. In addition, there is a need to develop attractive computer-based learning programs for students to use at home, especially for lower SES family students.

On the *national level*, as in other countries (e.g. South Africa; Mestry, 2014), although the Israeli Government has taken several steps towards addressing equity, compensation and social justice in education, there have been a number of challenges in the implementation of policies that have affected the process of bringing about fundamental changes and transformation in education. Inequalities based on sector, district and socio-economic status in particular, continue to be reproduced in a system that aspires to be egalitarian and democratic. Although progress has been made towards a just distribution of public funds, significant inequalities persist.

Based on previous studies (e.g. Mestry, 2014), indicating that there is a strong link between funding and educational outcomes, it is contended here that educational leadership funding policies should therefore be based on comprehensive analyses of the contextual situation in sector, district and family SE status, so that those who should benefit from funding do actually receive the benefits not only in their schools, but also in their homes. In this way, leadership policy should be designed to reduce gaps between sectors and districts in Israel, thus promoting social justice, increasing learning opportunities and encouraging academic excellence among students.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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