E-leadership of School Principals: Increasing School Effectiveness by a School Data Management System

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Abstract

In recent years, school management systems have become an important tool for effective e-leadership and data-based decision making. School systems emphasize an information flow and e-communication between teachers, students, and parents. This study examines e-leadership by secondary-school principals through the Mashov school system implemented in 500 Israeli schools in order to increase school effectiveness. Semi-structured interviews were conducted at the end of academic year of 2010-2011 with ten participants: eight secondary-school principals, a Ministry of Education supervisor, and a director of the school principals' training program.

The results indicate that the system provides extensive support for school principals in managing the organization, delegating responsibilities, promoting e-leadership of teaching staff, and, consequently, increasing pedagogical effectiveness of their school. E-leadership through the school system changes the entire school culture. It includes making data-based decisions, monitoring curriculum implementation and learning performance, interacting with teachers, students and parents, improving the school climate, and raising the level of student and parental involvement. The results are discussed in terms of the Island of Innovation and the Comprehensive Innovation models of technology implementation (Avidov-Unger & Eshet-Alkalai, 2011). In order to enhance e-leadership, we recommend school principals expanding the implementation of school systems among students and parents, delegating e-leadership responsibilities, and monitoring the level of teacher activity within the system.

Keywords: E-leadership; school data management systems; secondary-school / high-school principals; school effectiveness.

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Introduction

Online school management systems have become an important tool for effective management of pedagogical information and student data. The Israeli education system began a reform towards comprehensive integration of ICT technologies in order to develop and enhance students' 21st century skills. As a part of this process, schools should implement a school data management system in order to support e-leadership and e-communication among teaching staff, students, and parents.

School data management systems emphasize organizational aspects and the transfer of pedagogical information, such as curriculum performance, student function and achievement. One of these systems examined in this study is Mashov ("feedback" in Hebrew, and the acronym of "Immediacy, Transparency, and Supervision"), which operates in 2012/2013 academic year in more than 500 Israeli schools (approximately 13% of schools in the country). The system helps improve the work patterns of the management staff, especially in the areas of decision making, which are based on data and improved communication with teachers and students - essential components of school effectiveness.

This study focuses on e-leadership of secondary-school principals through the school management system. By interviewing 10 participants coming from diverse schools and professional backgrounds, the study explores how (1) the school management system supports e-leadership of secondary-school principals, (2) how the e-leadership of the school principals promotes e-leadership of their teaching staff and (3) affects school effectiveness.

The literature review section first discusses the role of school principals, traditional leadership, and e-leadership. Following that, the implementation of technology is presented from the perspective of individual differences and organizational decisions. To conclude the review section, the parameters of school effectiveness are discussed.

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Literature review

A school principal is a leader in the educational organization and his or her main role is to lead the continuous improvement in school environment, promoting student learning and education (Chirichello, 2010). Traditional leadership is a process in which one member of an organization influences and controls the behaviors of others in order to achieve common goals (Burns, 1978). Leadership in educational organizations is a significant factor affecting the effectiveness of the school. The school principal must see the entire school system and try to create a tight connection between the different dimensions for helping students to succeed. All of this should be done while trying to change processes, to promote teaching - learning, to increase performance and student achievement.

By analogy to traditional leadership, e-leadership refers to the ability of a person to influence the behavior of others in a digital technology-mediated environment (Chamakiotis & Panteli, 2011). Different terms have been used in various papers in order to address the use of technology to support leadership in educational institutions, including ICT leadership (Yee, 2000), IT leadership (Hollingworth & Mrazek, 2004), educational technology leadership (Kearsley & Lynch, 1994), and school technology leadership (Anderson & Dexter, 2005; Tan, 2010). This paper adopts the term e-leadership (Gurr, 2004) emphasizing the leading process empowered by technology instead of the technology itself. In addition, same papers use the terms mentioned above in different ways. For example, school technology leadership was defined in Anderson and Dexter's survey (2005) as presence versus absence of technology committee; technology leadership in Dexter's (2007) paper referred to principals' involvement in technology-related responsibilities at schools implementing laptop in classrooms. This paper refers to e-leadership as the usage of a school management system (not any educational technology) for exchanging updated pedagogical data and e-communication in order to increase school effectiveness by data-based decision-making and instant interactions among different stakeholders.

In the research of virtual teams the idea of distributed leadership in digital environments in opposition to traditional organisational leadership has become popular

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(Mehra, Smith, Dixon, & Robertson, 2006). Distributed leadership is defined as "a social distribution where the leadership function is stretched over the work of a number of individuals and the task is accomplished through the interaction of multiple leaders" (Spillane, Halverson, & Diamond, 2001, p. 20). In contrast to virtual teams, Israeli schools are traditional organizations with a hierarchical structure and a distributed leadership seems to be hardly applicable to them. Thus, e-leadership in educational organization mostly reflects the leadership style of the school principal and varies on the continuum from authoritarian style, e.g., a top-down leadership, to a delegating responsibilities approach (Tan & Aloysius, 2011).

The Mashov school system studied in this paper supports both hierarchy and delegating responsibility approach (see Blau & Hameiri, 2010). Each member of the organization receives access to the data according to his or her position: school principals have access to all the pedagogical information concerning their institution; heads of departments can see all the data concerning their departments; homeroom teachers have access to the information regarding the function of their students in different subject-matters; students can access their own information entered by different teachers; parents have access to the data concerning their children's learning and functioning. Thus, e-leadership by school principals is empowered by the possibility of monitoring, communicating and making data-based decisions on the whole-school level; heads of departments and homeroom teachers' leadership is strengthen by monitoring pedagogical data and by e-communication on the level of their departments or classes.

The adoption of e-leadership in educational organization can be discussed on the level of school principals from the perspective of individual differences among the participants and on the organizational level. Rogers' (2003) Diffusion of Innovation theory explains the variety in the rate of adopting new technologies by individual differences. Continuum of adopting innovations is normally distributed in a bell curve and ranges from innovators (2.5%) and early adopters (13.5%), to early majority and late majority (34% each), and finally laggards (16%). Based on this approach, e-leadership through a school system would differ according to individual differences in innovation adoption among the school principals.

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Analyzing the literature focused on implementing technology in schools in the organizational level, Avidov-Unger and Eshet-Alkalai (2011) found two main models of implementation: "Islands of Innovations" and "Comprehensive Innovation". In the Islands of Innovation model, the innovation is implemented only by a small fraction of the organization and is usually focused on a particular content area or a particular task (Mioduser, Nachmias, Tubin, & Forkosh, 2006). In contrast, in the model of Comprehensive Innovation, the implementation involves all levels of the organization, and thus creating a new organizational culture. Based on the findings of numerous studies Avidov-Unger and Eshet-Alkalai (2011) concluded that the assumption of success automatically spreading from the Island of Innovation to the rest of the organization is erroneous. The Island of Innovation remains isolated from the rest of the organization and even creates among decision makers the false illusion of innovative organization.

In the context of implementing a school data management system, the Islands of Innovation model seem to be unsuitable - the data pool and e-communication through the school are valuable only if at least most of the teaching staff are entering data and use the system on a regular basis (Blau & Hameiri, 2012b). Therefore, instead of gradual adaptation, on starting the implementation of a school data management system a principal should from the beginning include in the process the entire teaching staff. Moreover, according to Fuchs (1995), successful implementation of a change in schools is influenced by all stakeholders involved in the process, and to be substantial, the change should include not only teaching staff, but also students and their parents. Consistent with Fuchs' approach, some systems connect student data regarding school function, curriculum resources, intra-staff communication, and school-home linkages (Yee, 2000; Wayman, 2007). This claim received empirical support in large-sample comparisons between the implementation of the Mashov system investigated in this study among school staff only versus the implementation of the system by teachers *and* families (Blau & Hameiri, 2010). The results showed that the implementation among teachers and families, which can be called "Expanded Innovation" model (Blau & Hameiri, 2012a), lead to higher level of daily data exchange and e-communication among school staff compared to the "Comprehensive Innovation" model of implementation.

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School principals are the central figure in leading technological change in educational institutions (Tan, 2010). They can promote school effectiveness through data-driven decision-making (Main, 2009), by identifying and articulating vision and goals, developing high performance expectations, and fostering communication (Knapp, Copland, Plecki, & Portin, 2006). Principals also affect the instructional quality of schools promoting teacher professional development and organizational structures to support instruction and learning (Harris, Rutledge, Ingle, & Thompson, 2010).

School data management systems can help school principals work more efficiently by improving the tracking learning outcomes, behaviour, curriculum and other pedagogical data. These systems can significantly increase school effectiveness by providing on-demand updated data in different levels - individual student, class, subject-matter, or the entire school, and by strengthening communication among teaching staff, students and parents (Blau & Hameiri, 2012b). For example, Wayman, Conoly, Gasko, and Stringfield (2008) described how principals concerned about school ratings, used a school data system to track and provide special help to at-risk students.

The Mashov system investigated in this study includes two applications (Blau & Hameiri, 2012a): the school staff application which enables a secure online or mobile exchange of pedagogical information and communication between school stuff, as well as online or mobile interactions with students and their parents; the family application opens access to student data for students and their parents and offers them the possibility for a two-way e-communication with the school staff. Each member of the organization receives access to the data according to his or her position: school principals and vice-principals have access to all the information concerning their institution; heads of departments can see all the data concerning their departments; homeroom teachers have access to the information regarding the function of their students in different subject-matters; students can access their own information entered by different teachers; parents have access to the data concerning their children' learning and functioning.

Online interactions in the Mashov system are conducted via two main modes: (1) exchanging data by teachers regarding their lessons, such as lesson topics, educational materials, homework, as well as information about their students, such as attendance,

discipline, homework preparation, grades, and (2) direct two-way interactions among school staff, students, and parents by online or mobile logging into the system and sending / receiving messages through the system. Users can instantly access the system from computers or their mobile device for viewing statistics of how a student or class is functioning - formative and summative evaluations, numbers and frequencies of lateness, absences, behavior remarks, as well as lesson topics and homework (Blau & Hameiri, 2012a).

The mere presence of a school management data system does not ensure its effective use by a school principal and teachers. Data systems are a cost-effective, efficient investment when data are used to help inform decisions and improve practice; otherwise, it is an expensive waste of school resources (Wayman & Cho, 2008). There is much to be learned about the effective application of school data management systems and, as Wayman, Jimerson and Cho (2010) argued, the greatest lesson is the understanding that more explorations and learning are needed.

Research questions

This study explores how the implementation of a school management system enables e-leadership of secondary-school principals and their teaching staff, and promotes school effectiveness. The three research questions were:

1. How does implementing the school management system support e-leadership of secondary-school principals?
2. How do secondary-school principals promote e-leadership of their teaching staff?
3. How does the e-leadership through the system affect school effectiveness?

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Method

Participants

Six out of ten the participants were men (60%). The participants were eight secondary school principals in Northern Israel, a Ministry of Education supervisor, and director of the school principals' training program who was involved in training the principals during the implementation of the system. Previously the supervisor and the director of the training program had implemented the Mashov system in the schools they managed, and they related to the research questions from a broader view of their present positions.

Since 86% of Israeli schools implementing the Mashov system in 2011 were secondary schools, this study focused on secondary schools' principals. Eight participants-secondary school principals were implementing the Mashov school data management system in order to promote their own e-leadership and e-leadership of the teaching staff, which consequently increased school effectiveness. In order to increase representativeness, the sample includes principals of rural schools and schools situated in cities, from religious and non-religious sectors, participants having more and less seniority as school principals, more experienced (4-5 years) and less experienced (2-3 years) in using the school data management system. Previous quantitative log analysis of all schools implementing the Mashov data management system (Blau & Hameiri, 2012a) showed diversity in their level of activity within the system. Thus, for external validity reasons the principals were *not* chosen according to high level of their activity within the system or the activity of the school they lead.

Instruments

Semi-structured interviews were conducted with eight secondary school principals in order to investigate their e-leadership experiences through the school data management system. The interviews explored how the school principals use the system for making decisions based on updated pedagogical data, for communication with school staff, students and their parents. In addition, the interviews investigated how the principals monitor and promote data exchange and e-communication of head of the

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departments and homeroom teachers in order to increase school effectiveness. Table 1 presents the questions of the interviews and topics they addressed.

Table 1: The research instrument and topics addressed

Interview Topics	Interview Questions
A school background	Please give a short overview of the school you lead - the quantity and background of your students and teachers, the vision and key objectives of the school.
A principal's background	Tell me about yourself as a school principal - how many years you are in management positions? What roles you have been filled before this position?
The vision of educational leadership	What are, in your opinion, the key characteristics of a school principal?
The system as a management tool for a school principal	Describe the patterns of your work with the Mashov school system. What functions of the system do you use for management? Please give examples of your main goals as the school principal in the past two years. Which of them the system helped you to accomplish and which of them it couldn't help you to archive?
The added value of e-management for a school principal	What new management options are open to you since your school uses the system? Which of your management routines could not be done or would be very difficult without the system?
Benefits and costs of e-management on an organizational level	From conversations with school principals who don't have a school management system or from the period before the implementation of the system in your school, what are in your opinion the main benefits and costs of using a management system by educational organizations?
The system as a management tool for teachers	Please describe the level of use the system for management by your teaching staff. Are you satisfied with it? What do you do to increase or continue the usage? What advises can you give other principals in order to raise the level of use?
The system as a tool for curriculum planning and team work by teachers	Please describe how your teaching staff uses the system for curriculum planning and team work of homeroom and subject-matter teachers.
The system as an information source for students and parents	Please describe the level of use the system by students and their parents. Are you satisfied with it? What do you do to increase or continue the usage by families?
E-communication of a principal with teachers, students and parents	Please describe your communication patterns with teachers, students and parents through the system. Whether and how e-communication affects your face-to-face interactions with teachers, students and parents?
E-communication of teachers with students and	Based on monitoring the system, please describe online interactions among the teaching staff, between teachers and students and

parents	between teachers and parents.
	In your opinion, whether and how e-communication on the organizational level affects face-to-face relationships among the school staff, teacher-students and teacher-parents interactions?
Information exchange and e-communication as a part of a school culture	In your opinion, to what extent and why information exchange and e-communication with students and parents via the system is important or not important?
	Whether and how information exchange and e-communication through the system affect the school culture?
The system as a tool for enhance authority and delegate responsibilities	As a school principal, there are areas of personal responsibilities and those in which you delegate the responsibilities. Would you characterize the school management system as a tool which enhances your authority as a principal or the tool which allows you delegating responsibilities? Why?

For triangulation of the data presented by the school principals, a Ministry of Education supervisor and director of the school principals' training program were interviewed. Similarly to the principals, these participants view e-leadership on the whole-school level. Since some previous studies (e.g., Dexter, 2007; Lai & Pratt, 2004) have shown that middle-level school leaders have their unique needs and possess alternative interpretations of e-leadership, we did not collect data from school personnel.

Procedure

The study was conducted at the end of academic year of 2010/2011. It was the sixth year of implementing the Mashov online system by Israeli schools and the first year of launching its mobile interface (Blau & Hameiri, 2012a). Informed consent was obtained from all the participants. The participants were assured that they and their schools would remain anonymous.

Semi-structured interviews were conducted in the office of each participant. The interviews lasted about an hour and a half. They were recorded and the transcripts were analyzed using the qualitative content analysis technique in a bottom-up grounded approach (Bryant & Charmaz, 2012). Categories were formed by iterative reading of a sample of the interviews and then applied to the entire set of transcripts. The coding

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categories were exclusive; thus, each statement could be coded in one category. Thirty percent of the transcripts were randomly chosen and their themes were re-estimated by another rater. The inter-rater agreement was 91%, Cohen's $\kappa = .88$.

Results and Discussion

E-leadership by the school principals

Concerning the *first research question*, the study found that principals make extensive use of the school system for e-leadership: data-driven decision making, monitoring the functioning of teachers and students, delegating responsibilities of e-leadership to teaching staff, and interacting with teachers, students and parents. School principals based their pedagogical decisions and the dialogue with teaching staff on updated data regarding student performance, including achievement in the state tests, and student daily function, such as attendance, lateness, and homework preparation. They monitored progress of individual students and classes in different subject-matters and checked it concordance with the curriculum and pedagogical goals. Thus, the system support e-leadership of the school principals by providing extensive on-demand updated data in different levels and enabling data-based pedagogical decisions.

> N: "We can look at a student function with his or her homeroom teacher, comparing student performance in different subject-matters. We make pedagogical decisions regarding this student seeing "the big picture"… It is so different from leading the school in the pre-system period! I feel that the system upgraded our work, making the leadership more effective. I cannot imagine my work without it... E-leadership through the system makes me feel like the school leader of the 21st century."

Some of the school principals led by themselves the implementation of the system and it was clear that they were satisfied with the results and felt the sense of ownership for e-leadership through the system.

> L: "There was no culture of e-leadership before I arrived to this school. Everyone said: "I feel that…" and I changed things radically. I need to manage the school based on the real data. It is a culture of e-leadership that I brought to the school."

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In contrast, the principals, who managed schools where the system has been implemented before they got their position, reported a good level of implementation, but also noted their difficulty in exploiting the full potential of the system for e-leadership immediately after being exposed to it. This data is consistent with previous log analysis of the system (Blau & Hameiri, 2010), according to which exploration of different functions of the system lasting from a year to three years. The data of the current study also reflect the idea of "digital wisdom" (Prensky, 2009), according to which "digital immigrants" that did not grow in the digital era can successfully adopt and wisely use technological tools. After the initial period of adaptation, even the principals that did not lead the implementation of the system in their institutions could successfully realize its potential for e-leadership.

The results showed that offline leadership style of the school principals on the continuum between authoritarian and delegating responsibility approach is reflected in their e-leadership and vice versa, lessons learned from e-leadership experienced impact on their offline decisions and actions. This is consistent with the results of Jang and Ryu's (2011) study which focused on e-leadership skills learned through digital games and showed significant relationship between in-game and offline leadership of the participants.

E-leadership of teaching staff promoted by school principals

Regarding the *second research question*, the results revealed that in some schools the implementation was done in two stages - the first among school staff and the second phase among students and parents. The results indicate that participants monitor the exchange of pedagogical data and the amount of e-communication among school staff and between teachers and families in their schools. Based on this monitoring, they understand that implementing the system among school staff mostly enhances their own e-leadership, while implementation among students and families promotes e-leadership by both school principals *and* teaching staff.

> L: "Teachers use the school system as a tool for e-leadership because they can receive a detailed map of students in classes they teach and easily communicate with them."

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The school principals demonstrated willingness to expand the implementation among the parents and the community. Following the "Comprehensive Innovation" or "Islands of Innovation" models of implementing technology (Avidov-Unger & Eshet-Alkalai, 2011), this form can be seen as "Expanded Innovation" (Blau & Hameiri, 2012a), which includes important stakeholders outside the organization - students and parents.

School principals claimed that e-leadership through the school system has raised the level of parental involvement, which is reflected, inter alia in greater participation of parents at school events. Is seems that the school principals who lead the implementation of the school system among the families (and not only among the school staff), enter data relevant to students and parents, and promote e-leadership by teachers, enhance student and parent involvement in school issues. This conclusion based on the interviews with school principals and on the interview with Ministry of Education supervisor is consistent with the quantitative log analysis of teachers' activities (Blau & Hameiri, 2012), which showed that regular data entering by teachers enhance the involvement through the system by students and parents. Despite the importance of implementing the system among families, some of the principals did not know how to monitor through the system the extent of usage by students and parents.

Concerning the individual differences in promoting e-leadership among teaching staff by school principals, one of the participants described how the school vice principal delegates the responsibilities of e-leadership, and encourages the staff, especially homeroom teachers and heads of departments, using the technology to lead students and colleagues, while the past school principal clearly preferred traditional ways of leading the school. These differences in adopting innovations are consistent with the Diffusion of Innovation Theory (Rogers, 2003). It seems that the school vice principal is one of the "innovators" or "early adopters" of technological tools, while her past school principal can be attributed to the "late majority" or even "laggards". The finding of this qualitative investigation are also consistent with quantitative findings regarding the influence of teachers' openness to change and their attitudes towards ICT on online communication with students and colleagues and for pedagogical information search (Blau & Peled, 2012).

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Some principals and the school supervisor described their own concerns before and during the implementation of the system. The reasons included fear of change of some teachers, technical difficulties and the concern that e-communication will damage the quality of the school discourse taking place offline. It seems that these fears also reflect individual differences in adopting innovations described by Rogers (2003).

E-leadership and school effectiveness

Regarding the *third research question*, the study participants described how their own use of the system and the promotion of e-leadership by teachers consequently enhance pedagogical effectiveness of the school. These areas include making data-based decisions - on the level of individual student, class and stratum, tracking in concordance with curriculum, level of performance and student achievement, decentralization of leadership, and time management during pedagogical meetings.

> H: "If your aim is managing your organization effectively, focusing on specific goals, and achieve them, you cannot lead without data... Regarding the time management, before the implementation of the school system we were sitting hours and talking, talking, talking… Today pedagogical meetings are significantly more effective, because the homeroom teacher comes with data… Time management is an important component of the school effectiveness."

The school system improves school effectiveness by enhancing e-leadership of middle-level school personnel. It helps heads of departments planning and monitoring the implementation of curriculum in different subject-matters and enhancing student learning. Teachers enter into the system the topic of their lessons, homework, student data, answer student questions, and focus students in preparation for tests. Some of the principals described the use of class or subject-matter websites built in the school system for transmitting learning materials to students. Despite this option of having a class website interconnected with management functions of the system, most of the school principals were unaware of it, and, consequently, did not promote their teaching staff in this direction.

It was also noted by the participants that the system promotes curriculum planning, increases levels of communication with the school community, and changes the school

culture. The instant flow of updated information between different stakeholders creates the atmosphere of transparency and connections, improving the school climate and therefore enhancing the school effectiveness.

> S: "The implementation of the system has changed our work patterns, ways of exchanging information, and the entire school culture".

The results revealed that principals extensively use the system for e-communication with teachers, students, and their parents. This qualitative data by school principals is consistent with a previous quantitative log analysis of actual behaviour within the Mashov system by teachers (Blau & Hameiri, 2010), students and parents (Blau & Hameiri, 2012b). In concordance with the idea of the ubiquitous 24/7 communication supported by a school system (Chen, Hwang, Yang, Chen, & Huang, 2009), participants highlighted the importance of instant access to the data and ubiquitous interaction among teaching staff, and between teachers and families.

> H: "First we were concerned that online communication is distant and does not support high-quality interaction. Over time we realized that communicating through the system not only does not damage the quality of interaction, but actually enhances it."

The interviews revealed that the system opens the possibility of e-communication for students that are shy and have difficulties in expressing themselves in face-to-face communication. These students feel significantly more comfortable in written interactions with teachers and administrators. This finding is consistent with the CyberPsychology literature that the characteristics of the Internet as a protected social environment assist introverts to express themselves more freely online than offline (Amichai-Hamburger, 2007; Barak & Suler, 2008; Blau & Barak, 2012).

The findings show that the school principals are sensitive to the appropriateness of different media for different purposes and understand that in many situations e-communication through the school system cannot replace face-to-face meetings or telephone conversations. One of the participants described that in complex or sensitive topics, she stops written discussions through the system and asks for spoken conversation. Based on her arguments, it can be concluded that in sensitive complex discussions with teachers, students or parents, it is important to convey non-verbal

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social communication cues. Thus, non-verbal cues, for example, emotions conveyed through facial expressions and body language in face-to-face interactions or through human voice in telephone conversations, are missing in written interactions via the system. This finding is consistent with the idea of Media Richness Theory (Daft & Lengel, 1984) regarding the interconnections of medium feature and characteristics of conveyed message, as well as with the quantitative data of teacher media choice for communication with their colleagues and students (Caspi & Blau, 2011).

Conclusions and implications

This study investigated e-leadership by secondary-school principals through a school data management system, their promotion of e-leadership by teaching staff, and the effect of e-leadership on school effectiveness. The results showed that successful implementation of the school data management system enables e-leadership of school principals and teaching staff, and consequently increases the effectiveness of their schools. This is realized through data-driven decision-making, monitoring curriculum implementation, learning performance and student function, e-communication with teaching staff, students and parents, delegating responsibilities, and improving the school environment. The e-leadership of teaching staff requires that school principals lead the expanded form of technology implementation, which includes students and parents, delegate e-leadership responsibilities, as well as promote daily data entering and teacher-family two-ways e-communication in order to strengthen student and parental involvement and initiate significant changes in the entire school culture.

In order to enhance e-leadership through a school data management system we recommend using the Expanded Innovation model of implementation (i.e., implementation among school staff *and* families), monitoring of the level of teacher activity within the system, and delegating e-leadership responsibilities instead of keeping hierarchical e-leadership approach. Regarding e-communication via the system, enhancing online school discourse and especially promoting e-communication between school staff and students are recommended. However, school staff should be sensitive to the appropriateness of communication media for different purposes and when needed, replacing written interactions by face-to-face meetings or telephone conversations.

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This study is a qualitative investigation in relatively small sample of secondary school principals implementing one school data management system. Further research may explore the Expanded Innovation model of implementation in larger sample, in other school data systems and different cultural contexts. It would be interesting to cross-check the findings of interviews with the quantitative log analysis of actual e-leadership behaviour of school principals within a school system, and with observations of school staff using the data during pedagogical meetings.

References

Anderson, R., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly, 41*(1), 49-82.

Amichai-Hamburger, Y. (2007). Personality, individual differences and Internet use. In A. Joinson, K. Y. A. McKenna, T. Postmes, & U. D. Reips (Eds.), *Oxford handbook of Internet psychology* (pp. 187-204). Oxford, UK: Oxford University Press.

Avidov-Unger, O., & Eshet-Alkalai, Y. (2011). Teachers in a world of change: Teachers' knowledge and attitudes towards the implementation of innovative technologies in schools. *Interdisciplinary Journal of E-Learning and Learning Objects, 7,* 291-303.

Barak, A., & Suler, J. (2008). Reflections on the psychology and social science of cyberspace. In A. Barak (Ed.), *Psychological aspects of cyberspace: Theory, research, applications.* (pp. 1-12). Cambridge, UK: Cambridge University Press

Blau, I., & Barak, A. (2012). How do personality, synchronous media, and discussion topic affect social participation? *Educational Technology & Society, 15*(2), 12-24.

Blau, I., & Hameiri, M. (2010). Implementing technological change at school: The impact of online communication with families on teacher interactions though Learning Management System. *Interdisciplinary Journal of E-Learning and Learning Objects, 6,* 245-257.

Blau, I., & Hameiri, M. (2012a). Smartphones in school - is it really the next generation? Mobile pedagogical management by teachers and families. In Y. Eshet-Alkalai, A. Caspi, S. Eden, N. Geri, & Y. Yair (Eds.), *Learning in the technological era* (pp. 17-24). Ra'anana, Israel: The Open University of Israel. [in Hebrew]

Blau, I. & Presser, O. (2013). e-Leadership of school principals: Increasing school effectiveness by a school data management system. *British Journal of Educational Technology.* doi:10.1111/bjet.12088

Blau, I., & Hameiri, M. (2012b). Teachers-families online interactions and gender differences in parental involvement through school data system: Do mothers want to know more than fathers about their children? *Computers & Education, 59,* 701-709.

Blau, I., & Peled, Y. (2012). Teachers' openness to change and attitudes towards ICT: Comparison of Laptop per Teacher and Laptop per Student programs. *Interdisciplinary Journal of E-Learning and Learning Objects, 8,* 73-82.

Bryant, A., & Charmaz, K. (2012). Grounded theory and psychological research. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf & K. J. Sher (Eds.), *APA handbook of research methods in psychology, vol 2: Research designs: Quantitative, qualitative, neuropsychological, and biological* (pp. 39-56). Washington, DC, US: American Psychological Association.

Burns, J. M. (1978). *Leadership.* New York: Harper and Row.

Caspi, A., & Blau, I. (2011). Media choice for intra-school communication: The role of environment, user, and medium. *Journal of Educational Multimedia and Hypermedia, 20*(4), 337-360.

Chen, C.-H., Hwang, G.-J., Yang, T.-C., Chen, S.-H., & Huang, S.-Y. (2009). Analysis of a ubiquitous performance support system for teachers. *Innovations in Education and Teaching International, 46*(4), 421-433.

Chirichello, M. (2010). The principal as educational leader: What makes the difference. In S. G. Huber, R. Saravanabhavan, & S. Hader-Popp (Eds.), *School Leadership - International Perspectives* (pp. 79-100). Springer: Netherlands.

Chamakiotis, P., & Panteli, N. (2011). E-leadership styles for global virtual teams. In P. Yoong (Ed.), *Leadership in the digital enterprise: Issues and challenges* (pp. 143-162). Hershey PA: IGI Global.

Daft, R. L., & Lengel. R. H. (1984). Information richness: A new approach to managerial behavior and organization design. In B. M. Staw, & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 6, pp. 191-233). Greenwich, CT: JAI Press Inc.

Dexter, S. (April, 2007). *Show me the leadership: The impact of distributed technology leadership teams' membership and practices at four laptop schools.* Paper presented at the 88th Annual Meeting of the American Educational Research Association, Chicago, IL. Retrieved September 2, 2012, from http://edtechcases.info/analysis/Dexter-AERA07-4.11.07.pdf

Douglas H. N., Rutledge, S. A., Ingle, W. K., & Thompson, C. C. (2010). Mix and match: What principals really look for when hiring teachers. *Education Finance and Policy 5*(2), 228–46.

Blau, I. & Presser, O. (2013). e-Leadership of school principals: Increasing school effectiveness by a school data management system. *British Journal of Educational Technology*. doi:10.1111/bjet.12088

Fuchs, I. (1995). *Change - A way of life in schools*. Tel-Aviv: Cherikover publishers [in Hebrew].

Gurr, D. (2004). ICT, leadership in education and e-leadership. *Discourse, 25*(1), 113-124.

Hollingsworth, M., & Mrazek, R. (2004). Information technology leadership in education: An Alberta needs assessment. Learning and Technology Research, Stakeholder Technology Branch. Edmonton, Alberta: Alberta Learning. Retrieved September 2, 2012, from http://www.uleth.ca/education/sites/education/files/ITL_needs_research.doc

Jang, Y.-B., & Ryu, S.-H. (2011). Exploring game experiences and game leadership in massively multiplayer online role-playing games. *British Journal of Educational Technology, 42*(4), 616-623.

Kearsley, G., & Lynch, W. (1994). Educational leadership in the age of technology: The new skills. In G. Kearsley & W. Lynch (Eds.), *Educational technology leadership perspectives* (pp. 5-18). Englewood Cliffs, New Jersey: Educational Technology Publications.

Knapp, M. S., Copland, M. A., Plecki, M. L., & Portin. B. S. (2006). *Leading, learning, and leadership support*. Research report, Center for the Study of Teaching and Policy, University of Washington, in collaboration with the Wallace Foundation, New York.

Lai, K. W., & Pratt, K. (2004). Information and communication technology (ICT) in secondary schools: The role of the computer coordinator. *British Journal of Educational Technology, 35*(4), 461-475.

Main, K. (2009). "Mind the gap": cultural revitalization and educational change. School Effectiveness and *School Improvement, 20* (4), 457-478

Mehra, A., Smith, B. R., Dixon, A. L., & Robertson, B. (2006). Distributed leadership in teams: The network of leadership perceptions and team performance. *The Leadership Quarterly, 17,* 232-245.

Mioduser, D., Nachmias, R., Tubin, D., & Forkosh, A. (2006). *Pedagogical innovation involving information technologies and communications.* The Center for Science and Technology Education, School of Education, Tel Aviv University. Ramot, Tel Aviv University. [In Hebrew].

Prensky, M. (2009). Homo sapiens digital: From digital natives and digital immigrants to digital wisdom. *Innovate Journal of Online Education, 5*. Retrieved September 2, 2012, from http://www.wisdompage.com/Prensky01.html

Raybould, R., & Fauska, J. R., (2005). Organizational learning theory in schools, *Journal of Educational Administration, 43* (1), 22-41.

Blau, I. & Presser, O. (2013). e-Leadership of school principals: Increasing school effectiveness by a school data management system. *British Journal of Educational Technology.* doi:10.1111/bjet.12088

Rogers, E.M. (2003). *Diffusion of innovations* (5 ed). New York: Free Press.

Spillane, J. P., Halverson, R., & Diamond, J. B. (2001). Investigating school leadership practice: A distributed perspective. *Educational researcher, 30*(3), 23-28.

Tan, S.-C. (2010). *School technology leadership: Lessons from empirical research*. In Proceedings of Australasian Society for Computers in Learning in Tertiary Education (ASCILITE) Conference, Sydney, Australia (pp.896-906). Retrieved September 2, 2012, from http://repository.nie.edu.sg/jspui/handle/10497/4622

Tan, S.-C., & Aloysius, O. K.-K. (2011). Distributed leadership for integration of information and communication technology (ICT) in schools. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing Demands, Changing Directions. Proceedings ASCILITE Hobart 2011* (pp.1204-1214). http://repository.nie.edu.sg/jspui/handle/10497/4655

Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). *Teacher professional learning and development: Best evidence synthesis iteration (BES).* Wellington New Zealand: New Zealand Ministry of Education.

Yee, D. L. (2000). Images of school principals' information and communications technology leadership. *Technology, Pedagogy and Education, 9*(3), 287-302.

Wayman, J. C. (2007). Student data systems for school improvement: The state of the field. In *TCEA Educational Technology Research Symposium: Vol. 1* (pp. 156-162). Lancaster, PA: ProActive.

Wayman, J. C., & Cho, V. (2008). Preparing educators to effectively use student data systems. In Kowalski, T. J., & Lasley, T. J. (Eds.), *Handbook on data-based decision-making in education* (pp. 89-104). New York: Routledge.

Wayman, J. C., Conoly, K., Gasko, J., & Stringfield, S. (2008). Supporting equity inquiry with student data systems. In E. B. Mandinach & M. Honey (Eds.), *Data-driven school improvement: Linking data and learning* (pp. 171-190). New York: Teachers College Press.

Wayman, J. C., Jimerson, J. B., & Cho, V. (2010). *District policies for the effective use of student data*. Paper presented at the 2010 convention of the University Council for Educational Administration. New Orleans, L.A. Department of Educational Administration, the University of Texas at Austin. Retrieved September 2, 2012 from http://edadmin.edb.utexas.edu/datause/papers/Wayman_Jimerson_Cho_District_Policies_and_Data_Use.pdf

Mashov website [in Hebrew] http://www.mashov.info/default.aspx