Interaction between science teachers and school principals and its influence on technology implementation: A retrospective analysis

Yehuda Peled **Yael Kali** **Yehudith J. Dori**

Technion, Haifa

This paper describes a longitudinal study, in which the interaction between junior-high school principals and science teachers is characterized, and its influence on technology implementation is explored. Ten principals and 19 teachers who participated in a former study, which took place from 1998 to 2001, were re-interviewed and observed in 2003 to 2005. The teachers were classified into four types: initiator, follower, evader and objector, based on the mode and extent to which the teachers used these educational technologies. Principals were classified into four categories with respect to the way they motivated their science teachers to incorporate technologies into teaching, identified as initiating, empowering, permitting, or resisting. The principals were fairly consistent in the type of support they provided to their teachers throughout the seven years of the study. Teachers shifted in the ways they used technology; They leveraged on technology and moved up when they worked with an initiating principal and moved down when the principal was a "resister". The principals' longitudinal support or discouragement plays a crucial role in teachers' ability and motivation to use technology as an integral part of their teaching.

Background

Many researchers (e.g., Blumenfeld et al., 2000; Fishman et al., 2001; Fullan & Miles, 1992) have noted that the success of innovative education and of utilizing technology in classrooms depends on the school's environment and the principal's attitudes.

School's characteristics reflect those of its principal when incorporating information technology (Wiggins, 1970). In a previous research (Dori, Tal & Peled., 2002), which served as the basis of this study we laid out a theoretical framework for professional development of teachers who incorporate educational technologies and especially web-based learning into their teaching. In-campus workshops consisted of work group meetings and in-school support. We followed these teachers, documented their beliefs regarding web-based teaching, and analyzed the artifacts they had submitted. These teachers used a specially designed website, developed web-based learning materials and implemented them in their classrooms, thereby strengthened their confidence in the technology.

The framework has been applied to about 67 teachers from 16 schools. They were classified into four basic types: (1) The initiator and path-finder, who is an autodidact, and can find ways to cope with difficulties to apply technology-based instruction; (2) The follower and conformist, who will apply

technology when it is convenient; (3) The evader, who will use technology only when required; and (4) The antagonist, who will not use technology-based instruction under any condition. The extent of technology assimilation and professional development depended on the messages transmitted by the school's principal.

Four types of principals were identified: (1) The initiating principal, who defines and leads change processes and mentors the required organizational changes; (2) The empowering principal, who seeks to apply technology-based instruction and supports various teacher initiatives in this direction, but does not lead the required pedagogical reforms; (3) The permitting yet preventing principal, who theoretically approves technology-based instruction, but does not support the organizational infrastructures that are required for successful application; and (3) The resisting principal, who, for various reasons, objects any element of technology-based instruction.

This research seeks to explore the longitudinal influences of the principal's type on technology implementation in their schools. We set out to answer the following:

- How do teachers implement technology in their classrooms after five years from taking a technology-oriented program?
- What characterizes the principals' attitude toward technology implementation throughout the seven years of the longitudinal study?
- What is the effect of the principals on teachers' implementation of technology?

Methodology

Our research is longitudinal in nature, spanning a seven year period between 1998 and 2005. Data was collected through class observations, surveys, and interviews with the teachers and their principals. The current retrospective study involved two rounds of interviews with selected teachers and principals. Ten principals out of the original sample of 16 and 21 teachers (who were still employed in these ten schools) who took part in the initial study, 1998-2001 were interviewed twice again, in 2003 and in 2005, to determine their attitudes toward incorporating technology into the school. A detailed analysis of the school and its principal provided the basis for their categorization.

Results

The follow-up interviews with principals have indicated that after five years, their approach toward technology remained the same. Hence, each was classified to the same category as before. In two cases, the approach of the principals became somewhat more extreme

Unlike principals, the teachers' approach to technology-based instruction changed considerably during that time. With the encouragement, support and vision provided by an initiating principal, teachers who were categorized previously as followers, evaders, and even objectors, changed their attitudes to a more positive one during the study.

Table 1 reveals that - the initiating and the empowering principal types caused their teachers to advance to higher level types of educational technology implementation, while the permitting yet preventing and the resisting principal types caused their teachers to regress to lower level types.

Specifically, as indicated by Arrow **I,** teachers who were described as initiators under initiating and empowering principal continued to develop and benefited from the school's attitude toward technology use in the classroom. as indicated by arrow **IA**, under the leadership of an initiating principal, one teacher who was initially categorized as a follower (conformist) became an initiator, and, as indicated by arrow **II**, two other teachers adopted some of the characteristics of an initiator (but remained classified as followers). One evader became a follower (indicated by arrow **III**), and one teacher who was originally defined as objector showed slight changes in his attitude (indicated by arrow **IV**), but was still categorized as an objector.

Table 1: Teachers and school types - mutual effect on incorporating technology in teaching

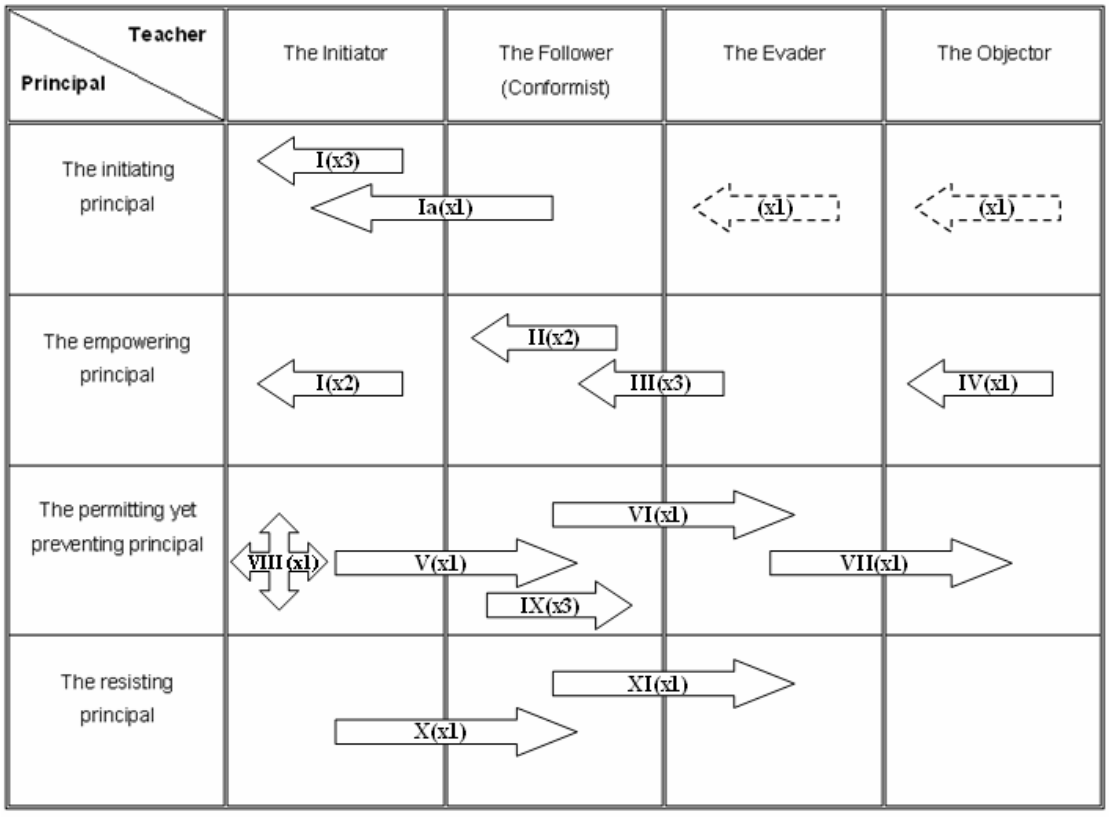
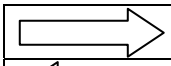
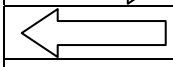
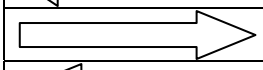
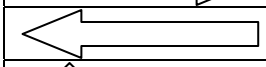
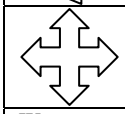


Table 1 presents the effect of the principal type on the teacher type. The arrows in the table indicate the direction and extent of the change teachers went through in their approach to incorporating technology into their teaching based on their two interviews and their principal's interview. These changes are tightly linked to the principal's support (or lack thereof). A dotted arrow (appearing only twice) denotes findings based on the principal's interview alone. The Arabic number inside each arrow denotes the

number of interviewed teachers who went through the indicated change, while the Roman numeral is used for reference in the sequel.

	Short Arrow pointing right, represents a teacher which inclines to perform as a higher type teacher, but does not as yet have those criteria
	Short Arrow pointing left, represents a teacher which inclines to perform as a lower type teacher, but does not as yet have those criteria
	Long Arrow pointing right, represents a teacher which escalates along the type scale
	Long Arrow pointing left, represents a teacher which descends along the type scale
	represents a teacher which does not change it's type
IX	Roman numbers represent the specific arrow
(x3)	Number of teachers the arrow represents

The opposite effect was found for teachers in schools managed by principals characterized by the two lower types. Under the leadership of a permitting yet preventing principal, one teacher was demoted from initiator to a follower, one was demoted from follower to evader and one was demoted from evader to objector (arrows **V, VI & VII** respectively). Another teacher moved down in her characteristics within the definition of a follower (arrow **IX**). One teacher, an initiator type, straggles to maintain her CMC teaching in spite of her principals' attitude (arrow **VIII**)

In the school managed by a resisting principal, one teacher, originally classified as an initiator, was demoted to a follower, and one follower was demoted to an evader (arrows **X & XI** respectively). This consistent trend can be attributed to the antagonistic environment induced by the principal, who suppressed teachers' initiatives and good intentions. In a school whose principal resists introduction of technology, even an initiating teacher is highly likely to gradually lose the drive to be an initiator and make extra efforts, feeling like she or he are "fighting windmills."

We found that the type of the principals we identified originally in the first research persisted and remained the same in the second and third interview. Moreover, the extreme principal types, the initiating on one hand and the resisting on the other hand became more entrenched in their extreme positions throughout the years, claiming to be more self-convinced that their stand is the right one.

Discussion

Our finding that a change in a school managed by a principal who does not cooperate or lead the process, will seldom succeed is supported by Foster, Loving and Shumate (2000). Our findings that show higher use of Web-based teaching where the principal is involved and encourages teachers, are also supported by Hodas (1993) and Supovitz and Turner (2000). The principal types identified and characterized in this research provide a basis for predicting his/her teachers' implementation of technological innovations in general, and Web-based teaching in particular, into their classes.

The data indicated that under the influence of the initiating principal, a teacher is often promoted to a more "advanced" type. This may be due to the principal's support. The follower, who is used to do

what is expected of him, will be "upgraded" to an initiator, who suggests changes and presents ways for implementation. Likewise, an evader, who was willing to occasionally cooperate with a team, now fully cooperates, and may suggest improvements. Encouraged by an initiator principal, the initiator teacher types will bring her skills to complete fruition.

Under the leadership of an initiating principal, a follower (conformist) teacher may become an initiator. The same type of teacher will abandon introducing new technology into a school whose principal discourages such activities. Finally, an antagonist teacher will show almost no signs of initiation, regardless of whether she has the principal's support.

The other three principal types cause the opposite effect. They demote the type of a teacher to a less "advanced" type. Moreover, a resisting principal discourages initiator and follower teachers and therefore they might become antagonist because of the suppressive environment. In a school whose principal resists the introduction of technology, even an initiating teacher will gradually lose his drive to put in extra effort. He will cease to be an initiator and continue to teach without any, or very little drive.

References

Blumenfeld, P., Fishman, B. J., Krajcik, J., Marx, R. W., & Soloway, E. (2000). Creating usable innovations in systemic reform: Scaling up technology-embedded project-based science in urban schools. *Educational Psychologist*, 35(3), 149-164.

Dori, J. Y., Tal,T. R. and Y. Peled (2002). Characteristics of Science Teachers Who Incorporate Web-Based Teaching. *Research in Science Education*. 32 (4), 511-547.

Fishman, B.J., Gomez, L.M., & Soloway, E. (2001). New technologies and the challenge for school leadership. A white paper for the Joyce Foundation Wingspread Meeting: *Technology's Role in Urban School Reform: Achieving Equity and Quality*.

Foster, E. S., Loving, C. C., & Shumate, A. (2000). Effective Principles, Effective Professional Development Schools. *Teaching and Change*. Thousand Oaks, Sage Pub. Pp 76-97.

Fullan, M.G. & Miles, M.B. (1992). Getting reform right: What works and what doesn't. *Phi Delta Kappan*, 73(10), 745-752.

Hodas, S. (1993). Technology Refusal and the Organizational Culture of Schools. *Education Policy Analysis Archives* [On-line]. Available: http://olam.ed.asu.edu/epaa/v1n10.html

Supovitz, J.A., & Turner, H.M. (2000). The effects of professional development on science teaching practices and classroom culture. *Journal of Research in Science Teaching*, 37, 963-980.

Wiggins, Thomas W. (1970). Conceptualizing Principal Behavior in the School Climate: A Systems Analysis. Paper presented at American *Educational Research Association Annual Meeting*, (Minneapolis, Minnesota, March 2-6, 1970) (ED041387)