A Model for Bridging the Gap between an After-School Program and the Science-Technology Program in Middle Schools

Thesis for the Degree of Doctor of Philosophy

By Orna Fallik

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Abstract

In recent years, a growing number of researchers and educators have called for measures to bridge the gap between formal and informal education. To date, research and practice have shed little light on the sustainability of such measures. The main goal of this thesis is to design and study a model to bridge the gap between a formal learning context (junior high school science and technology classrooms) and an informal learning context (Kamatz/Young Science Groups). Kamatz aims to promote the achievement of under-achieving junior-high students by involving them in an after-school program which uses an Active Science approach.

A pilot study demonstrated that bridging did not emerge spontaneously between the two learning contexts; moreover, certain conditions were required to bridge the gap between the contexts. Drawing both on the extant literature comparing formal and informal learning and on the pilot study's findings, a two-dimensional matrix model was developed for this thesis. One dimension of the matrix presents four theoretical and practical aspects of the learning environments: Organizational, Cognitive, Affective and Social-Environmental .The other dimension is comprised of four design principles for bridging the gap between formal and informal learning contexts: 1. Recognition by the educator teams in both contexts of the importance of bridging; 2. Mutual acquaintance of both curricula by each educator team; 3. Preparation of students to reduce the ‘novelty space’ regarding the informal learning context; and 4. On-going dialogue between the both educator teams. Synthesizing the two dimensions results in sixteen practical steps for building and enacting a bridging program. We call this the “4X4 Model for Bridging between Formal and Informal Learning Contexts”, since it is composed of four aspects and four design principles (leading to sixteen practical steps); this name also highlights the importance that we ascribe to its holistic

implementation. The working assumption of this thesis is that only a bridging program that responds to all sixteen practical steps can lead to effective and sustainable bridging. The research questions focus on the feasibility of the bridging program, its sustainability, and its influence on the students and educator teams, as well as on the organizational systems involved in enacting the bridging program.

Based on this initial model, a program was developed for bridging the gap between both learning contexts. This bridging program was implemented over a two-year period in five junior high schools that sponsored the Kamatz program. It included workshops for educator teams and bridging activities in both learning contexts. The study design consisted of a qualitative subjective-holistic methodology that allowed us to upgrade the model and the bridging program during the course of the research. Research methods included: in-depth interviews with 13 science and technology teachers and 5 Kamatz guides; direct observations of bridging activities; documentation of the educator teams' workshops (5 teacher workshops and 5 guide workshops); and informal conversations with the Kamatz program participants, the teachers and guides that were involved in the research, and other stakeholders.

The thesis explores the interface and dialogue between the educator teams and the organizational systems in the context of two key challenges: (1) bridging the cultural differences between the two systems and (2) promoting under-achieving students to realize their potential the formal learning context. The activity theory and the related “expansive learning” theory (Engstrom, 2001; Leont`ev, 1978; Vygotsky 1978) were used as a theoretical framework for carrying out the research. This theoretical framework positions the human being as a cultural and social product and relates to development of organizations that share common language, culture and context. Based on this framework, the unit of analysis was the teachers’ group or the guides’ group and not the individual within those groups. With regard to the students, individual students comprised the unit of analysis, each functioning as a case study.

The results of the research demonstrate successful adoption of the bridging program by the educator teams and the organizational systems, and they document the bridging program's contribution to the students and the educator teams, as well as to both learning contexts and their organizational systems. The contribution to students includes: (a) increased motivation to learn; (b) expanded perceptions about learning and knowledge; and (c) increases in knowledge, skills and new capabilities. The contributions to the educator teams fall in four areas: (a) increased knowledge and changed perceptions with regard to the teaching context and implementing the bridging program in both contexts (separately and in combination). The teachers

acquired new understandings about their students (e.g., "There's no such thing as a weak student."); the guides acquired new understandings about the teachers (e.g., regarding the teachers' workload and their expertise). The teachers and the guides understood that it is important to bridge the gap between both contexts, to collaborate and to consider each other's schedule; (b) changes in the educators' behavior toward their students; (c) changes in the relationship between the educator teams; and (d) development and implementation of spontaneous bridging activities beyond the initially- planned bridging activities. The pathway of change involved changing educator teams' knowledge and perceptions so that they recognized the importance of bridging and therefore changed their behavior to help their students improve their achievements. While the formal and the informal systems were cut off from each other in the beginning, the educator teams from both systems came to understand the advantages of each program and the need to establish a relationship between the two programs in order to promote under-achieving students. The Kamatz program came to appreciate the importance of not only its own work, but also the work of the school context. The school system recognized the potential of the Kamatz program to develop students' motivation as well as the benefits for more effectively promoting the cognitive and social competencies of other students in the class. Hence, the research demonstrates the feasibility of the model and the need to implement an integrated approach to supporting under-achieving students and show the sustainability of the bridging program. In fact, two years after the study terminated some of the bridging program activities continue to be enacted by both organizational systems. A complementary analysis of the process that led to the sustainability of the program was carried out using the diagnostic tool developed by Fishman and Krajcik (2003) for identifying sustainable curricular initiative. in science study. This analysis allows one to characterize and understand the processes that brought about the observed sustainability of the program. With the support of the mediator/researcher, the program succeeded in adapting itself to the organizational systems. In addition, the organizational systems succeeded in operating the program. Both the formal and informal systems succeeded in operating and further developing the program.

The model researched in this thesis has three unique characteristics: (1) Comprehensiveness: A review of the research literature on efforts to bridge the gap between formal and informal learning contexts elucidated examples that relate only to part of the aspects or one of the design principles of the model; (2) An holistic approach: In the literature there are no examples that synthesize across the design principles and the aspects to illuminate all of the practical steps which are crucial for building an effective and sustainable bridging program; (3) Practical implementation: The model identifies the practical steps for designing an appropriate bridging program. These steps

are formulated as a generic outline that can help in designing and assessing any specific bridging program.

The thesis includes recommendations for using the model and the bridging program, as well as agenda for future research.