Teachers' Professional Development through Teaching-Learning-Evaluation Portfolio Processes

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Abstract

The educational system in general and teachers specifically, have been undergoing many changes over the years. The system is dynamic and unstable, suffering from phenomena such as teacher turnover, the need to absorb new teachers, overburdened teachers juggling with many classes each year, etc. In order to develop significant teaching, the educational system must offer more effective professional development methods than those existing today—ones that can upgrade teaching methods and improve learners' achievements.
The purposes of the research were:
1) to clarify and represent the contribution of the pedagogic processes to teachers' professional development, and
2) to examine and characterize which trends are reflected through science teachers' pedagogical and teaching processes over four years.
A four-year longitudinal study examined Science for All teachers' work quality, as expressed in their students portfolios. The Science for All program is appointed to high-school students who are not majoring in sciences studies. The results describe the teachers' teaching and pedagogical processes. Most indices show that the teachers' teaching and pedagogical processes were improved. The parameters that evaluated in teaching processes were: integration of scientific ideas in assignments and expression of individual thinking by students. The parameters that evaluated in pedagogical processes were teacher–student dialogue, evaluation characteristics and assignment diversity. Alongside these findings there are qualitative findings. Teachers developed unique initiatives that reflected through the pedagogy and didactics they implemented in the teaching–learning–evaluation processes.
On the basis of this experience, a model was developed, representing the ranked professional development of the science teachers based on integrating the portfolio in the ongoing learning process.

1. Theoretical framework

The educational system in general, and teachers, specifically, have been undergoing many changes over the years. The system is dynamic and unstable, suffering from phenomena such as teacher turnover, the need to absorb new teachers, overburdened teachers juggling with many, many classes each year, etc. In order to develop significant teaching, the educational system must offer more effective professional development methods than those existing today—ones that can upgrade teaching methods and improve learners' achievements.
The McKinsey report [1] which focused on the issue of "How the world's best-performing school systems come out on top", referred to, among other things, the quality of teachers as a main factor in achieving success, and as such, the investment in teachers' professional development as a significant factor with a proven contribution. The issue of teachers' professional development has yet to be resolved in most countries around the globe. The growth of teachers necessitates innovation, adaptation to changes including acquiring of new skills [2].
The essence of pedagogical processes in classroom is the transformation from content knowledge to pedagogical content knowledge in the context of specific students in a specific class [3]. According to Shulman (ibid) it's the PCK. It reflects teachers' professional development, which is viewed as a continuum of ongoing processes, which begins with the pre-service training program and progresses through workshops throughout their careers [4]. Teacher must develop throughout his or her career for two main reasons: one is related to the changes and developments occurring within the professional arena while the second speaks to the fact that the essence of the profession requires this type of development. Development of real expertise in teaching is a direct result of experience and teaching is a skill that can be acquired while working and gaining experience [5].

The need for professional development is also linked to difficulties and challenges in working with students. There is high teacher turnover in schools and this hurts the school quality processes negatively [6]). Professional development that is continual and intensive has been found to have an effect on raising students' achievements.
How can we promote such a system in a specific knowledge area? How can we cope with all these interfering variables and bring about the creation of a highly-functioning advanced knowledge area that meets its objectives over the long-term?
The *Science for All* program tries to cope with all these factors through deep and complex evaluation processes that drives the system into responding both to the needs of students and teachers.
Teaching and learning processes in which the evaluation is an integral part of the complete process facilitate the creation of an evaluation perception [7].
Deriving benefits from evaluation data is also a part of evaluation perception. Correct use of data as a part of it contributes to continuous improvement of the educational system [8].
The *Science for All* program, which targets high school students who are not majoring in science, reflects the approach that all students can learn science and emphasizes the relevance of science to the individual. This program focuses on scientific ideas and thinking skills that enable the learner to seek, find and process critically the information that may be needed to make decisions based on facts and rational thinking.
The purposes of the research were:
1) to clarify and represent the contribution of the pedagogic processes to teachers' professional development, and
2) to examine and characterize which trends are reflected through science teachers' pedagogical and teaching processes over four years.

2. Methods

The present research describes a longitudinal study that collected data over a four-year period. It is a constructive-qualitative study integrating a quantitative aspect. Each year participants undergo a summative assessment for future planning requirements [9]. On the basis of a qualitative analysis of what the students produced, that reflects the quality of their teacher work, the results were classified according to criteria that had been decided upon beforehand, and each criterion was given a quantitative ranking.
According to Daley and Kim [10] assessing teachers through a well-planned process that combines different elements is objective, diverse, multi-dimensional, linked to learning achievements, especially—supportive of teachers' professional development.

3. Data sources

The *Science for All* staff comprises about 17 district instructors and about 230 teachers. The present study was based on the findings of the sample evaluation done in 2010-2013. Each year about 60 portfolios submitted by about 30 teachers are checked and evaluated. Given that we are talking about a random sample, some teachers were sampled more than once.
The portfolios were evaluated by a group of 20 well trained teacher-evaluators in accordance with criteria known to students, teachers and teacher-evaluators. The conclusions of this process were summarized in a written report for each teacher that related to different elements according to the evudences.
In order to enlarge the number of teachers exposed to the evaluation process, teachers at the beginning of teaching by a portfolio, were given the opportunity to join the evaluation sampling process as assistance evaluators, following appropriate training.
In addition to analysis of the four-year process, district instructors also held individual meetings (on average once a month) with each teacher in the field in order to examine implementation of knowledge and pedagogy in the real life.

4. Results

In table 1 the findings were displayed. Some elements were investigated only in 2112-2013. These items were added after additional characteristics were identified and additional needs arose following gathering of the results of earlier years.

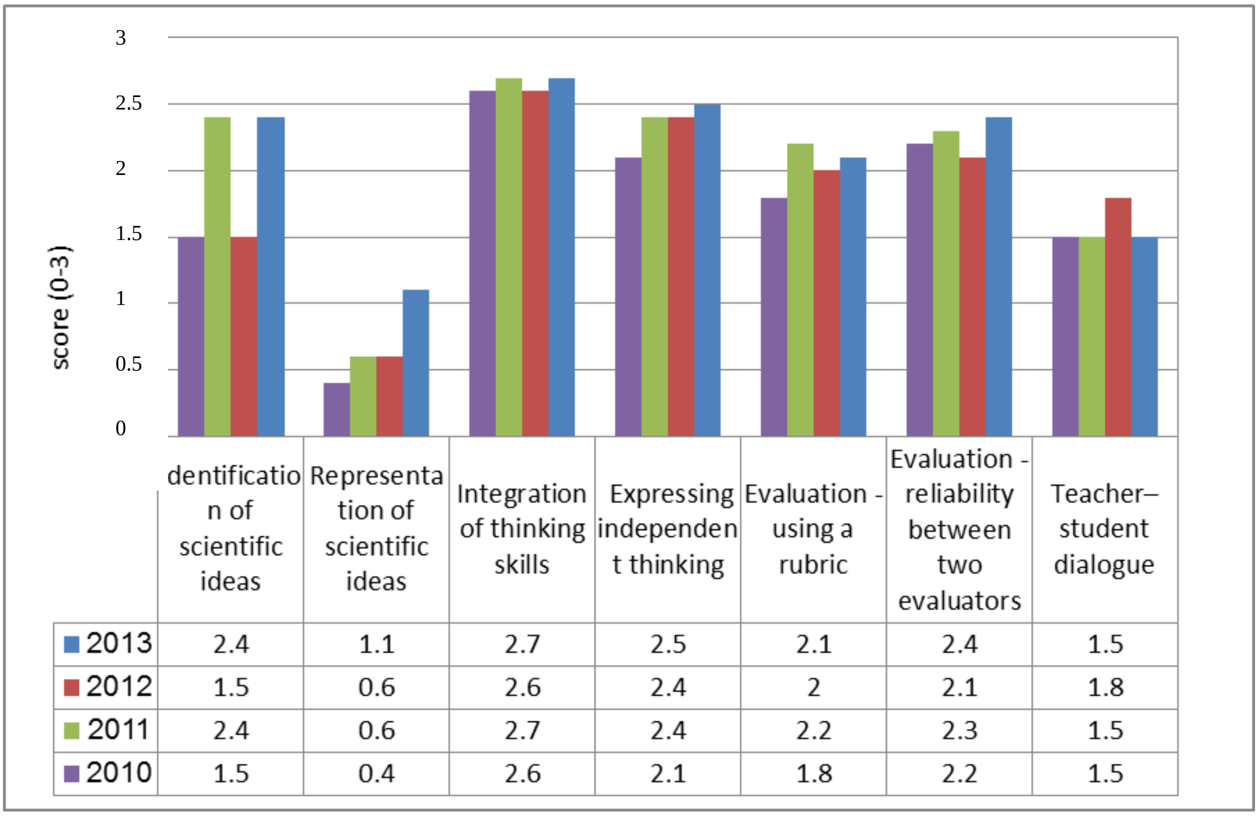
Table 1: Sample evaluation components and scores for the years 2010-2013

PCK components		2010	2011	2012	2013
Integrating scientific ideas in assignments	Identification of scientific ideas	1.5	2.4	1.5	2.4
	Representation of scientific ideas	0.4	0.6	0.6	1.1
Integration of thinking skills		2.6	2.7	2.6	2.7
Expressing independent thinking		2.1	2.4	2.4	2.5
Evaluation	Using a rubric	1.8	2.2	2	2.1
	Reliability between two evaluators	2.2	2.3	2.1	2.4
Teacher–student dialogue		1.5	1.5	1.8	1.5

Legend:: 3=exists to a great extent; 2=exists to a moderate extent; 1- exist to a minimal extent; 0=doesn't exist at all

Figure 1 describes the teachers' pedagogical content knoeledge between 2010-2013. Most indices show that the teachers' pedagogical approach is improving. A certain drop in the teacher–student dialogue is seen between 2012-2013.

Figure 1: Teachers' Pedagogical Content Knoeledge (PCK) processes between 2010-2013



Also the indices of the components included in PCK partially improved. The largest improvement was in elements related to identification and presentation of scientific ideas. In the advanced component of application of scientific ideas—the representation—there was a rise,but those results were Significantly lower .
The findings related to the skills component show higher levels in 2010-2013, expression of the independent thinking rose over the four years. An improvement trend is visible in PCK.The significant change in PCK is reflected in improvement in teachers' ability to deepen learning of scientific concepts.
In evaluation aera the changes that appear are not stable. There are movements that reflects the process that is still going.
Alongside these findings, there are qualitative findings from the continious/ ongoing interactions between the district instructors and the teachers. These findings paint a picture of enthusiasm and performance. The district instructors describe the unique products that were developed and enhanced by the field experienced teachers on the basis of the knowledge they accrued and the pedagogy they developed in workshops over the years. These products meet the specific needs of students. For example: Development of a scientific e-book, development of a journal focusing on different scientific phenomena that had been taught, in parallel to development of traditional tools—learning games, posters, wall newspapers and models, building of individual evaluation tools, building of rubrics, finding ways to represent scientific ideas

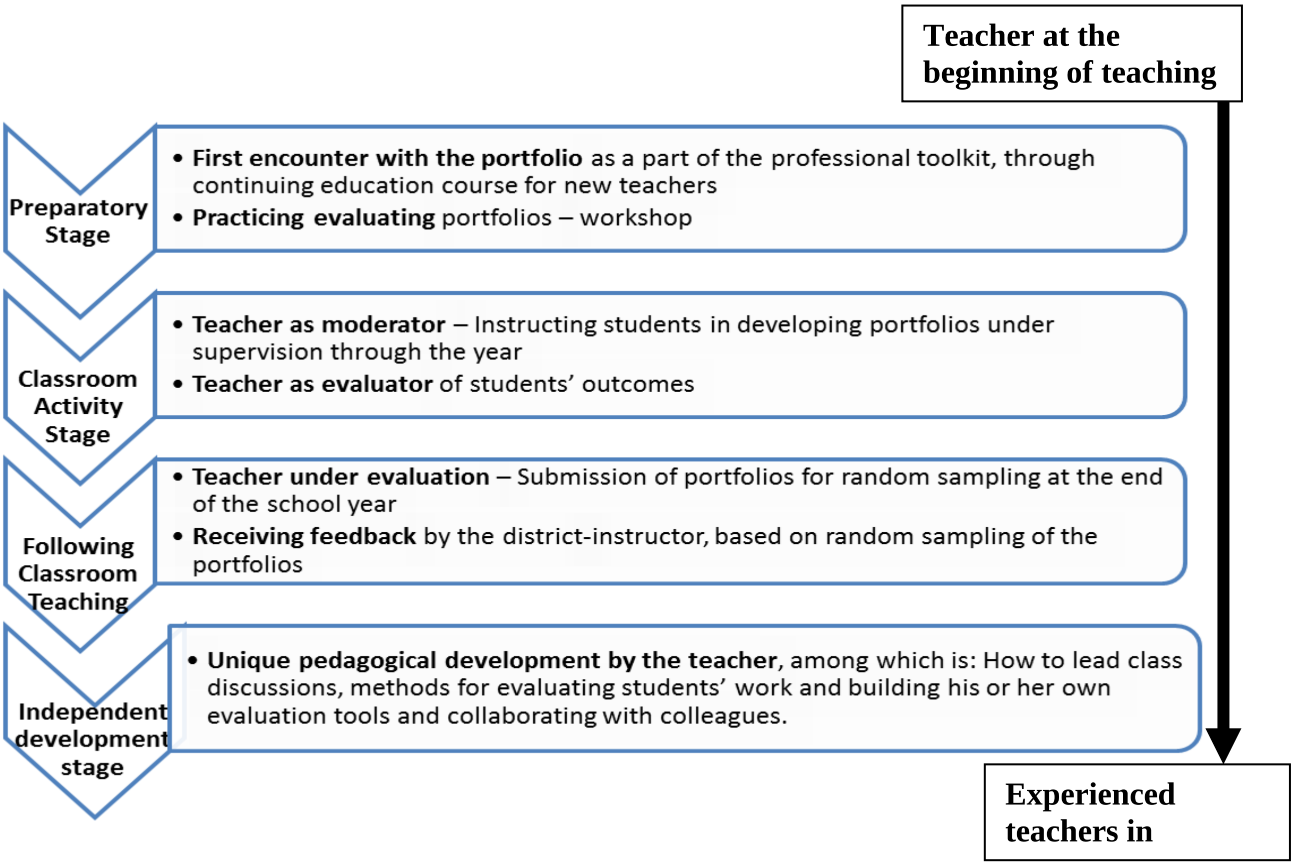
5. Conclusions

These processes—which use the evaluation of students' outcomes—are the significant ones for the advancement of teachers and safeguarding of their pedagogic and teaching perspective in their knowledge area.
Findings indicate that the strengths and weaknesses of teachers' work were similar throughout the four years and that some changes for the good resulted following work with the teachers each year. These findings derive from the nature of the field of study:
A very heterogeneous student population: different sectors (Jews–Arabs, ultra-Orthodox–secular, different cultures), and different socio-economic levels, largely characterized by a moderate to low cognitive ability. Furthermore, there is the phenomenon of teacher turnover—through retirement, taking sabbaticals, moving to a different district—as a result of which new teachers enter the system and consequently, there is a need for continuing education courses to be repeated each year. The upshot of these changes is a continual need to repeat the assimilation among new teachers of the *Science for All* program's pedagogic and teaching outlook, through repeated interaction between supervisors and instructors, and teachers.
From these findings the need for continual, intensive work with teachers is self-evident. It may be that creating a permanent professional community of teachers who regularly physically and virtually reach out to each other to provide mutual support, help in solving problems that arise and shared uncertainties, may contribute to raising the level of students' achievements as can be seen in students' outcomes.

5.1 Scholarly significance of the study

Some values of the results remained unchanged; in some cases they increased over the years, and in some cases there was even a drop in comparison between the years.No big differences were found during the years. The strength of the qualitative findings indicate that the instructor–teacher interaction is very significant to the teachers' professional development. And what is required from the teachers? That they be aware all the time of the PCK perspectives.Teacher cannot simply "teach the material". His or her instruction must reflects this perception
In light of the above, the authors propose a unique model of professional development for teachers in teaching–learning–evaluation through portfolios (see Figure 2).

Figure 2: Model for the professional development of teachers in teaching–learning–evaluation through portfolios



This research reflects a new way of teachers' professional development that enrich the teachers' PCK through portfolios, and enable them to interalize and assimilate the principles of this methods. The proposed model supports teachers and enable to grow teachers in continuous and significant way of teaching.

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