**Measuring Science Instructional Practices of Arb and Jewish science teachers in the elementary and intermediate schools in Israel**

**Abstract**

Teacher's science instructional practice plays an important role to improve student interest and achievement in sciences.

The results of the international exams (PISA and TIMSS) in the science and technology profession show over the years and consistently, a gap in the achievements of Arabic-speaking students compared to their counterparts Hebrew-speaking students. The researchers pointed to various factors behind the above gap, one of the factors that has been raised is the socio-economic gap between the 2 sectors. It was found that the more the country economically developed, the stronger the association between socio-economic status and educational outcomes.

The present study intended to examine and characterize science teaching practices used by Arab and Jewish teachers in elementary and middle schools from the perspective of the new generation science standards (NGSS).

The research will use mix methods. The quantitative part will be carried out using a questionnaire developed and validated in United States, which measures Science Instructional Practice. The tool will be translated into Arabic and Hebrew and will be validated by the internal validity process. The quantitative part will be carried out using semi-structured interviews in order to understand the reasons that stands behind the quantitativer results.

It should be mentioned that the above research will be the first stage of more comprehensive research which will include additional stages such as planning professional development based on insights from the current proposed research.

**Theoretical Background**

**Introduction**

Research indicates that a teacher's science instructional practice plays an important role to improve student interest and achievement, more than advanced degrees or teaching experience and thus, identifying a core set of science teaching practices may be one key to improving science education (Kloser, 2014).

There is a wide agreement between educators around the word about the importance of providing appropriate and advance science education to the entire students in schools, advance science education is a need based on the recognition that science is part of the general education needed today, and will be needed even more in the future for anyone who will contribute to society.

Advanced science education for children provides an infrastructure for development and success in both the personal and national dimensions, and can be considered as a seed that will bear fruit in the future in the form of an active citizen involved in decision-making processes with ability to contribute to the company's functioning and growth.

The effect of teachers’ content knowledge (e.g. Wayne & Youngs, 2003), and teachers’ pedagogical content knowledge (e.g. Schneider & Plasman, 2011) on student learning have been the focus of extensive research across disciplinary content areas. Although the importance of these variables, they are not sufficient to predict teachers’ impact on student learning (Cochran-Smith et al., 2012).

Research on science teaching practice has recently gained attention from researchers as an important parameter to affect and improve students who learned science their engagement in learning science and achievement in science education because it focuses on the “work of science teaching” (Gallimore, Ermeling, Saunders, & Goldenberg, 2009; Kazemi, Franke, & Lampert, 2009; Windschitl, Thompson, & Braaten, 2008).

Here in Israel, scientific education has special important for Arab minority. The acquisition of scientific education by Arab students will increase the possibility of integrating them into the high-tech labor market, which could contribute to reduce the economic gaps between them and the Jewish majority, and facilitates their integration into the Israeli economy, life and society.

Despite the importance of science education for the Arab minority in Israel, the results of the international exams PISA and TIMSS (National Authority for Measurement and Evaluation of Education, 2017) in the science and technology profession show over the years and consistently a gap in the achievements of Arabic-speaking students compared to Hebrew-speaking students.

Several studies have been established to reveal the reasons behind the above gap as well as to identify factors that can help reducing this gap (Hatab, Bourboy, & Manor, 2012; Nahum, 2018). various factors have been suggested behind the above gap such as, socio-economic situation of the Arab minority population, allocating less and unequal resources to the Arab education system compared to the Jewish education system, In addition, various culture and pedagogical reasons have been suggested. Moreover, Kim, Cho, and Kim (2019) found that the more the country economically developed, the stronger the association between socio-economic status and educational outcomes.

Various studies have examined the impact of the cultural context of science education in the Arab compared to Jewish society and have argued that traditional cultural differences in teaching and learning strategies applied in each community can be a key factor in the differences between two communities. for example, the researchers (Dkeidek, Mamlok-Naaman, & Hofstein, 2011) found that culture, tradition, rules, social structure, and ways of life play an important role in developing students' ability to ask question. The researchers (Markeck, Ellex, Mamlok-Namman, Hograt, Kortam, Dkeidek, & Hofstein, 2016) argued that a science teacher in the Arab society, unlike a teacher in the Jewish society, considers himself as a scientific resource of science knowledge in the classroom and the expected his students to receive the knowledge to Remember it and repeat it. the researchers (Hatab, Bourboy, & Manor, 2012) pointed out to the quality of teaching in Arab schools especially advance and modern teaching practices such as the critiques and challenging teaching by the teachers within the classrooms as one of the factors that can contribute to reducing the above gap.

In recent decades, a variety of methods for teaching and learning practices in science and technology have been proposed, the most recently one was the new generation science skills (NGSS) reform (NGSS Lead state, 2013, NRC 2012) . The reform was first proposed in 2013 in the United states and one of its goals was to allow teachers flexible planning of teaching and learning and that to motivate students to learn science and to enable them to integrate well into civilian life. The new generation of standards reform is based on a number of learning and teaching practices such as collaboration, asking questions, designing researching, analyzing and interpreting results, using mathematics and quantitative thinking and more

science teacher today has to cope with many and varied requirements and have to use advance teaching and learning practices in order to provide advance and modern science education to their students, Therefore, they are required to make frequent changes and keep up date with constant professional development.

Examining the science teachers' practical knowledge is the basis of any long-term professional development program, so it was decided to conduct this research in order to examine the teaching practices used by science teachers in the elementary and middle schools from the perspective of the new generation of standards for teaching and learning science and engineering (NGSS) in both Arab and Jewish sectors

**The Relevance of the Current Research**

* The results of the study could use those who responsible for the professional development of science teachers in Israel, particularly in the Arab community to plan long-term professional development around the science teachers practices.
* The results of the study could be used by science teachers to observe in their own field work, and may push some of them to develop their work and to adopt innovative science teaching practices.

**Research Questions**

Our research questions will be:

1. What are the science instructional practices that are existed in the Arab and Jewish sectors in Israel?
2. How culture affects science instructional practices?
3. How science instructional practices affected by:
   1. Number of years of experience the science teacher has
   2. Number of Hours of professional development (PD) the science teacher learned
   3. Age of the science teacher
   4. The number of pupils in the science classes?
   5. Gender of the science teacher.

**METHODOLOGY**

**Research Type**

Our research will use mixed methods research methodologies.

We are intended to use a questionnaire developed by Hayes, Lee, DiStefano, O’Connor, and Seitz (2016) which measures Science Instructional Practice. The tool will be translated into Arabic and Hebrew and will be validated by the internal validity process.

Another tool will be semi-structured interviews which will be take action with the science teachers that aim to deeply understand the quantitative results.

**Research Population**

The research population will consist of Arab and Jewish teachers who teach science at the elementary and middle-high school level.

**Research Sample**

The research sample for the quantitative part about 100 science teachers from different ages, years of experience, number of pupils that they teach in their classes from each sector, i.e. about 200 science teachers total.

**Research Variables**

In-Dependent variables: culture, Number of years of experience, hours of professional development, science teacher’s age, number of pupils in the science classes, Gender of the science teacher.

Dependent variable: science instructional practice

**Research Tools**

Quantitative research tool: we are intended to use a questionnaire developed by Hayes, Lee, DiStefano, O’Connor, and Seitz (2016) which measures Science Instructional Practice (SIP) - see Appendix 1. The tool will be translated into Arabic and Hebrew and will be validated by the internal validity process.

Qualitative research tool: semi-structured interviews which will take action with the science teachers

**Data Collection**

The SIP questionnaire will be disseminated to the 200 science teachers from Arab and Jewish sectors as a printed version, then their data will be summarized using Microsoft Excel.

Semi-structured interviews will be held with a random sample of the same teachers who responded to the questionnaire (about 10% of them). The interviews will be voice recorded, then transcribed using Microsoft Word.

**Data Analysis**

Quantitative data analysis:

* the alpha-Cronbach test will be done in order to find out the reliability of the results.
* correlation analysis will be done in order to find the answer for research question number 2 and 3.

Qualitative data analysis: we will use thematic analysis in order to

**Ethical Issues**

The research will be done on a voluntary base, each science teacher who will participate in our research can choose to participate or not according to his/her choice.

The participants of our research will get a brief description of our research aims, then they can choose to participate or not participate in our research.

**Research Importance**

In United States, National goals for science education include increasing the number of students who pursue advanced degrees in science (National Research Council [NRC], 2012), reducing disparities in participation of minorities and women in the science workforce (NRC, 2012; President’s Council of Advisors on Science and Technology [PCAST], 2010), and improving science literacy.

Our research is intended to find out how science instructional practice affected by the culture that the science teacher teaches within it. Science instructional practice plays an important role in development of scientific thinking skills and scientific literacy within the pupils who learned sciences, and therefore from one side, increasing the numbers of students from Arab sector who pursue advanced degrees in science, and from another side, reducing disparities in participation of Arab minority in the science workforce in Israel.

**Limitations**

The following points could be the limitations to our intended research:

* Low science teacher's response to our quantitative and qualitative data collection, either from Arab or Jewish sector.
* Some teachers may not collaborate positively with our research. This could be as a result of thinking that we are intended to assess their work as a teachers.