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Parallels and differences in Arab chemistry textbooks from different countries and teachers' view on chemistry education in Syria

Introduction

In the last decades, the Arab world was facing substantial changes. There is not much research of how these changes in economy, political systems and living conditions are affecting education in general and chemistry education in particular. Recent research reported still a quite traditional view on chemistry teaching in Arab countries by the teachers (e. g. Al-Amoush, Markic, Usak, Erdogan & Eilks, 2014). A recent study suggests a strong influence of culture on the chemistry classroom learning environment leading to such a traditional view (Markic et al., in print). However, the direct relation of certain aspects of culture on the teaching and learning of chemistry in Arab countries is not yet fully understood.

Educational reforms are on the agenda in many Arab countries (Al-Amoush, Markic & Eilks, 2011). Arab world governments realized in the last two decades that the educational infrastructures would ruin unless reform procedures start going on and including the teacher is the main key for successful innovation in education (Anderson & Helms, 2001). Reforms in education in Arab countries focus among others the use of the Internet, digital media, and other modern technical facilities. However, much progress is still to be made and this is more believable for some countries than for others. With small populations and high investments in their national networks, some Gulf states have matched international standards in ICT infrastructure, whereas geographically larger but poorer countries in the region stay behind (UNESCO Institute for Statistics, 2013). In spite of low level incomes and regressive economic situation in many Arab countries investment in educational reforms differs much (The World Bank, 2008). However, information about the curriculum and non-technology based pedagogies is still hard to find.

Modern topics like sustainability (e. g. Burmeister & Eilks, 2012), nanotechnology (e. g. Blonder & Sakhnini, 2012), or climate change chemistry (e.g. Ekborg & Areskou, 2006) were about the topics of great interest for curriculum innovation in the last decade for researchers and educators, especially in the Western world. But implementation of new curricula and modern pedagogies seems to be a challenge both for industrialized and developing countries, and research and development in modern curricula is still limited in countries with a lower level of economic development. Corresponding knowledge about the curriculum and teaching practices in chemistry education in Arab countries as a ground for curriculum reform is still rare.

Since the teacher is the center of any educational reform investigations into school teachers' prior knowledge and beliefs should be focused in educational research more deeply (Haney Czerniak & Lumpe, 1996; Trigwell, Prosser & Taylor, 1994). But also the resources teachers can use need to be analyzed, e.g. school textbooks. This study is focusing grade-10 chemistry textbooks from different Arab countries, namely Syria, Jordan, Palestine, Egypt, Kuwait and Saudi-Arabia. Additional research is conducted about teachers' view on the curriculum and pedagogy by interviews in the case of Syria.

Our research intends to explore insights into teaching practices in Arab chemistry education in the case of Syria and beyond, into Syrian teachers' views on recent developments, into the applied teaching practices, and into how current events, like the political crisis in Syria, affects chemistry education practices.

Method and sample

The sample of the first part of the research reported in this paper are six chemistry textbooks from different Arab countries, namely Saudi-Arabia, Kuwait, Syria, Jordan, Palestine and Egypt. The analysis focuses mainly the curriculum and the representation of practical work. It compares the chemistry textbooks regarding several points on four levels, namely general structure, textual material, pictorial material, and conceptual levels.

A second part of the project is built on interviews with 15 secondary school teachers from Syria. A semi-structured interview with 21 to 25 questions was used to investigate the classroom learning environment. Interviews were conducted to collect data on teacher-textbook interaction, student-textbook interaction, teacher-technology interaction, student-technology interaction, teacher-laboratory interaction, student-laboratory interaction. The teachers' age range was from 25 to 50. The teachers' answers were analyzed, taking into account factors like the sector type (private vs. public), students' numbers in the class, teachers' ability's to use the Internet, talking about historical figures, regularity of laboratory work, teachers' attitudes towards modern topics like environment, food chemistry, nanotechnology, but also the history of chemistry. A final focus was on how chemistry teaching is affected by the Arab spring period and how the students interact with the curriculum under new circumstances regarding the demographic changes in Syria.

Results and discussion

Approximately all the chemistry textbooks have five chapters in average with about eight problems each in every chapter. The average chapter length in each book is the same. Typical topics are atomic structure, chemical calculation like molarity yield and weight percentage, organic chemistry concepts, salts, bases and acids, chemical and physical changes, chemical bonds, vapor pressure, solubility, chemical bonding, and thermochemistry. Although the main focus is similar, the presentation of the content differs from book to book in a few details. Reviews are provided for example in Saudi-Arabia, the most important concepts are collected in the last part of the book to let the student review their knowledge.

Most of the textbooks take mainly a traditional subject matter and structure-of-the-discipline oriented approach to learning chemistry. Basic chemistry like atomic structure is the major focus. Modern topics like sustainability and nanotechnology are not to be found except the textbook from Egypt. The survey shows that most textbooks in Arab countries still lack in contextualization and presenting modern and meaningful application from chemistry. There are a few trends towards special approaches to chemistry in some of the textbooks, like the Palestinian textbook focuses clearly on technology and engineering and provides much more illustrations of instruments and engineering work than any other book.

Historical figures can be found in all chemistry text books but there is more focus on Arabic historical figures than on Western ones, like in the Syrian book. In this book it is mentioned clearly that the students should be mainly familiar with Arab historical figures in science. Religious references can be found in the countries where the Islamic background is more dominant in life and society, e. g. Palestine, whereas it is rare in countries which try to follow quite liberal mentality in terms of religion or secular models, e. g. Syria.

The nature of illustration also differs from one country to another regarding imagination but also the view on society. There is some similarity in the textbooks which belong to Gulf countries, however these differ from Syria and Egypt where other parallels can be found. The differences between the books concern among others the use of picture colors. E. g. in Egypt colors are much brighter and friendly than in other countries. But also stereotypes differ. In Egypt there are pictures of woman and man in the same photo working together. Such pictures do not exist in textbooks from Saudi-Arabia or Kuwait. English words exist in

all textbooks from the Gulf countries and Egypt, with less use in Jordan and Palestine. There is no use of English words in the Syrian book where only Arabic language is being used. From the teachers' interviews it can be concluded that there is low quality of education resulting in low performing student and less educated teachers alike in Syria. Teachers are demanding for reform although they do less complain of lacking or shortage of chemicals or equipment in the school. The teachers feel suffering from issues like bureaucracy and missing support by school authorities. For example most of the teachers are complaining on the lab keepers who to their feeling are often unavailable in the school. This situation was considered getting even worse by the current political crisis in Syria.

Conclusions

All the Arab countries have a related cultural background. However, presentation of science in textbooks differs. These initial findings suggest that there is also a strong influence by the socio-political environment on how chemistry is presented in the curriculum and this differs even within the Arab world countries. These initial findings need to be elaborated more in depth. This might help to better understand differences between the Arab countries, e.g. differences between the Gulf countries in one side, which are rich but very traditional, and the near east countries in the other side which are close to poverty but middle liberty exists. Such understanding of parallels and differences might help to better understand the influence of cultural backgrounds, norms, stereotypes, but also socio-economic views on the curriculum and the learning of science in Arab countries. However, also comparison of science education in the Arab countries with external references from other countries or cultures as suggested in Al-Amoush et al. (2014) or Markic et al. (accepted for publication) might help to better understand the situation in Syria. Such knowledge might be valuable to guide reform in science education in Arab countries better towards modern curricula and pedagogies fitting the corresponding socio-cultural and economic environment.

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