

Cross cultural curricular transfer in mathematics education

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Underpinned by the scholarly work on contextually and culturally responsive standards for mathematics education, this paper presents the case study of a mathematics curricular transfer experience between the UK and Egypt, situated in the Higher Education sector. The data is based on a wider extended observation of the Egyptian classroom implementing the UK based mathematics curriculum, which incorporated multiple checkpoints including a focus group discussion with students. The data were analysed using a mapping approach against the spectrum of philosophies in mathematics education, which also acted as a theoretical framework for the study. Rooted in a local traditional philosophy of mathematics instruction, the findings of this study indicate traces of an initial shift, in instructor approach, towards a more fallibilist approach for relating to mathematics as a subject matter. The study suggests tools that enable behavioral change in mathematics instructor agency.

Keywords: implementation; curriculum; Egypt; Higher Education

Setting the scene

This study takes place in an Egyptian Higher Education classroom context, where undergraduate mathematics students (also referred to as freshmen) are exposed for the first time to a Higher Education mathematics curriculum. The study is more largely situated within the context of an ongoing academic collaboration between an Egyptian university and a UK based university. As part of this collaboration, the aforementioned curriculum has been designed by the UK university to be implemented with the aforementioned freshmen student batch. As academic liaison, I have been closely monitoring the process of curricular transfer throughout the full term of instruction, where the designed curriculum has been executed for the first time. In the following, I will be utilising my experience of extensively observing this curricular transfer experience. For the scope of this paper, I start by reviewing the literature on curricular transfer. Then, I present the philosophical positions in mathematics education as a theoretical underpinning for this study. This is followed by a presentation of the research design and a discussion of the findings and implications of this study. In light of the recent involvement of UK based mathematics education scholarship in the design of cross-national curricula around the world (Klees et al., 2012), I believe this study is relevant for scholars devising mathematics curricula across contexts and educators implementing curricula that have been developed outside of their local contexts. This is particularly relevant, in light of the recent shift towards a remotely facilitated classroom that caters for a global learner and where cross contextual transfer of a curriculum is becoming a daily challenge (Makramalla & Stylianides, 2019).

Cross contextual curricular transfer

Greer et al. (2009) have discussed the notion of designing and implementing a mathematics curriculum in a culturally responsive and contextually relevant manner. The teaching and learning of mathematics is not a neutral enterprise (Apple, 2013). The way mathematics as a subject matter is perceived by the instructor, the society and the learner to a large extent affects the unfolding of the learning experience in the mathematics classroom (Cohen & Ball, 2007). For example, mathematics as a subject matter is often perceived as the underpinning knowledge needed to be attained by the learner, in order to equip them in studying the sciences. Mathematics can also be perceived as an empowering field that in itself creates problem solvers, analysts and critical thinkers (Stylianides & Stylianides, 2013). In each of the cases, the perception of the nature of mathematics as a subject matter affects the way the mathematics curriculum gets implemented in the classroom.

In his work on curricular transfer, Ernest (2009) differentiates between three types of curriculum; namely the intended curriculum, the implemented curriculum and the attained curriculum. The intended curriculum mainly represents the documented plan of how the study of mathematics is to unfold in a classroom setup. The implemented curriculum represents the actual enactment of that written curriculum in the classroom. The attained curriculum represents the curriculum acquired by the students. This study investigates the gap between the first two forms of curriculum, namely the envisioned curriculum and the implemented curriculum.

Theoretical framework: Philosophical positions in mathematics education

In his study of the new philosophy of mathematics and its unfolding in terms of the classroom experience of mathematics education, Ernest (2009) differentiates between two philosophies of mathematics education, that could arguably be considered as extending on two ends of a spectrum. On the one hand, Ernest (2009) presents the traditional – also referred to as absolutist – philosophy of mathematics education. On the other hand, there is the fallibilist philosophy of mathematics education.

According to the traditional philosophy of mathematics education, mathematics is perceived as a neutral and objective body of knowledge that is abstract in nature. It is composed of fixed and rigid rules and procedures that make up a discrete form of knowledge. Learning mathematics is therefore perceived as difficult and hence is only approached by a minority of gifted students.

The fallibilist philosophy, on the other hand, views mathematics as a socially and culturally constructed subject matter, whereby knowledge is created through a process of continuous inquiry. Mathematics is therefore perceived as accessible for all learners and as constructed through the creative process of discovery and problem solving.

With this spectrum of philosophical positions in mind and situated in the aforementioned cross-contextual collaboration for mathematics module curricular design, this study aims to consider the transfer between the intended curriculum and the implemented curriculum. The research question is therefore: *How does the underpinning philosophy of mathematics get transferred within the context of cross-cultural curricular handover?*

Research design: Methodology and Findings

This paper adopts the single case study (Yin, 2012) as an overarching methodology. I choose to focus on the bridge between the intended and implemented curriculum, whereby the intended curriculum is underpinned by a philosophy of mathematics education that has been envisioned by the UK based Higher Education Institution and the implemented curriculum is conducted at the Egypt based Higher Education Institution.

As part of the larger study, from which this paper is derived, the intended curriculum has been mapped against the spectrum of philosophies in mathematics education (see Figure 1). This mapping has been confirmed through follow up meetings with the curriculum designers during the curricular handover meeting.



Figure 1. Mapping of intended curriculum

As part of my wider role as academic liaison between the UK based Higher Education Institution and the Egyptian Higher Education Institution I have studied the mathematics curriculum (intended curriculum) provided by the UK based Higher Education Institution. I have attended the handover meetings between the curriculum designers and the local module lead who acted as instructor of the module and as liaison to future instructors of this mathematics curriculum module. I have had numerous conversations with the module lead during the implementation of the mathematics curriculum. I have held a focus group discussion with selected students, representing different attainment levels and genders from the freshmen cohort during the implementation of the mathematics curriculum and I have had numerous individual meetings with students after finishing the implemented curriculum.

While the aforementioned investigation more largely informs my data analysis, for the particular scope of this paper, I report, about the focus group discussion with the students, as my main data collection point. The student sample was composed of five students, representing three attainment levels and both genders. The focus group took the form of a semi-structured interview. I utilise the spectrum of philosophies in mathematics education outlined earlier (Figure 1) as my analytical framework against which the data in my study is mapped (Yin, 2012). The analysis and discussion of the findings was then further cross checked with the module lead.

It is out of scope of this paper to present a detailed account of the data mapping. More elaboration in that regard could be made available in a larger account of the more holistic study. For the scope of this paper, it is worth mentioning that students described their learning of mathematics to be very procedural in nature. “It’s mostly about being well practiced in knowing how to adopt this kind of procedure to solve this kind of task. We are expected to solve so many examples in so little time so that we master the technique”. The discussion with the module lead underscored the impression that the students were having. As stated by the module lead: “They need to be really well practiced in mathematical procedures as this will act as the main building block to enable their performance in the technical courses yet to come.” Upon mapping the data received from the students and confirmed by the post-

discussion with the module lead, the main findings indicated an implemented curriculum that has been implemented as rather traditional in nature. Figure 2 builds on the initial mapping that had been illustrated in Figure 1.

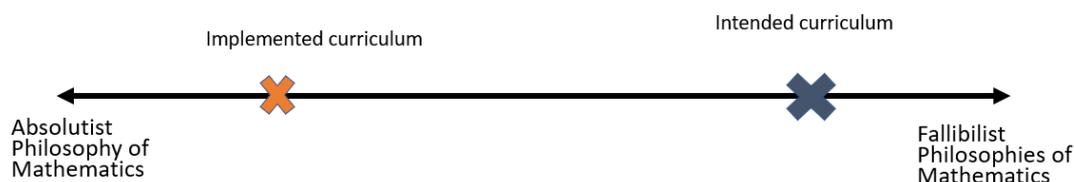


Figure 2. Mapping of findings

It is worth mentioning that student responses to a very high degree aligned with the instructor's responses, in view of the underpinning philosophies that underscored the implementation of this module. In the instructor's own words: "Within the scope of curriculum implementation, mathematics is considered as the slave subject that needs to be mastered so that they [the students] can use the procedures later in more advanced science courses". This perception can be argued to move the implementation of the mathematics curriculum away from being experienced as a creative space, as illustrated in Figure 2, and discussed in the next section.

Discussion of findings

The findings of the study indicate a gap between the intended curriculum and the implemented curriculum that is rooted in a gap between the underpinned perceived philosophy of mathematics in each of these curricular forms. This is further underscored by the instructor's (who also acted as module lead) perception of mathematics as expressed in the findings section. While this finding aligns with similar previous findings of other cross-contextual curricular transfer settings (Cohen & Ball, 2007), I believe it is worth discussing ways to bridge this gap.

As this curricular transfer experience unfolded, I have found that the shift in module lead philosophy with regards to perceiving mathematics education has gradually taken place over time. It was almost impossible to negotiate a shift between both mappings on the spectrum, depicted in Figure 2, in one incident. The shift seemed to be possible if gradually the local module lead is exposed to different means of how this curriculum can be taught, coupled with an extended account of one-to-one meetings discussing what this implies in terms of our perception of the underpinning philosophy of mathematics as a subject matter.

In response to the research question, curricular handover in itself does not facilitate transfer of the underpinning envisioning of the philosophy of mathematics education. The latter is only possible via the extended creation of an endorsing micro-culture at the receiving party.

Implications for future research

This study shows the deficit of cross contextual curricular transfer in itself. In other words, it confirms the gap between intended curriculum and implemented curriculum and underscores that across contexts, the main reason for this gap lies in a contextually different perception of mathematics as a subject matter. The study proposes that curricula transferred across contexts would be revisited by the receiving party. This can happen, if at the locally receiving context a micro-culture is

established and fostered that exposes the receiving party of an often foreign approach of curricular implementation. This exposure technique is best effective, if extended over a long period of time to enable gradual behavioral change, and if coupled with one-to-one local curricular transfer sessions discussing the underpinning shift of philosophy needing to be established in order to achieve a shift in curricular implementation.

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