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Culture contextualisation of mathematics instruction. A draw a scientist test (DAST) analysis

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Culture Contextualization of Mathematics Instruction

A "Draw A Scientist Test (DAST)" Analysis"

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ABSTRACT

This work intends to study preparatory school students' perception of mathematics instruction within the local context of the Egyptian teaching and learning culture. The target is to unveil some insight about the power dynamics between teacher and student as well as amongst the students in the classroom. To address students' perceptions of their own classroom mathematics pedagogy, the study adopts a sequential double filter integration method that is founded in literature. This method seeks to interpret preparatory school students' drawings in response to a given prompt. The analysis unveils an apparent paradox in relation to the classroom power dynamics that is perceived by students. The results are then addressed and further synthesized with the help of a contextual understanding of the wider cultural framework. In addition to that, some principles of the social cognitive theory also serve as a platform for explaining the results. Future work needs to consider adopting the results of this study as part of a contextual comparative analysis; contrasting classroom power dynamics of different teaching and learning environments.

Keywords: contextualization, mathematics pedagogy, social cognitive theory, power dynamics.

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CHAPTER 1

INTRODUCTION

1.1. Background

Knowledge development in a school classroom can take on a very wide variety of forms. This depends on several factors; some of which include the learning culture, the teacher background and the student and parent expectations. To better understand that let us consider the examples in Figures 1.1 and 1.2.

Figure 1.1. Classroom Context1[1]. *Figure1.2.* Classroom Context 2[2]

Figures 1.1 and 1.2 both show examples school students developing knowledge about a new subject in a classroom. When looking closer at both learning scenarios, it becomes quite clear that although the students in both figures seem to be within the same age group, possibly

[1] https://www.google.com.eg/search?q=classroom+culture&biw=1366&bih=599&source=lnms&tbm=isch&sa=X&sqi=2&ved=0ahUKEwjq4qGGrcnJAhXM1RoKHbAeCY8Q_AUIBigB#q=classroom+conservative+school&tbas=0&tbm=isch&imgrc=FS-VAwDZcKnxXM%3A

[2] https://www.google.com.eg/search?q=classroom+non+conservative+school&espv=2&biw=1366&bih=599&source=lnms&tbm=isch&sa=X&ved=0ahUKEwj7na_SrcnJAhVKBBoKHblBBQUQ_AUIBigB#tbm=isch&q=classroom+peer+work+&imgdii=LwQz8H3YC85r4M%3A%3BLwQz8H3YC85r4M%3A%3ByaHxH-K6FGLPZM%3A&imgrc=LwQz8H3YC85r4M%3A

studying the same subject matter, both situated in a classroom and mixed in terms of gender; yet there is a clear difference in the way students in each environment are developing their own knowledge. In the first example, students are being taught in a deductive manner where the teacher is standing at the center of the classroom lecturing and explaining to the students. The students are requested to passively receive the information they are being taught. The instruction methodology is by no means differentiating according to needs in the student audience body. Figure 1.2, on the other hand, shows an example of students cooperatively working on a project in the classroom. The teacher is sitting at the same level as the students. Instead of being passive receptors, the students are actively engaged on together brainstorming and slowly constructing their own understanding about a topic. The hands-on activity helps the students to be focused and to interact together.

Hence, it can be deduced, that despite the similarity in the student body; yet the formal context of teaching and learning is very different across both figures. Resulting from that is logically also a different student perception about the nature of knowledge and the nature of knowledge formation in each of the two scenarios. In other words, the process of inquiry that results in knowledge formation is very differently perceived by the students in the example provided in Figure 1.2 when compared to their counterparts in the other example (Figure 1.1). The different context simply results in a different learning experience all together. This study intends to particularly focus on exactly that principle, the concept of contextualization. The target of this work is to reveal the degree to which formal learning and teaching can be context dependant. To better understand that, it is important to first consider what is meant by the context of learning and teaching. Some considerations in that regard are depicted in Figure 1.3. Figure 1.3 presents some contextual factors deduced from literature that affect the context of teaching

and learning. The next Chapter will present a more elaborative study on some of those factors, nevertheless at this stage it is important to keep in mind that any teaching and learning environment is the product of cultural, political and economic factors.

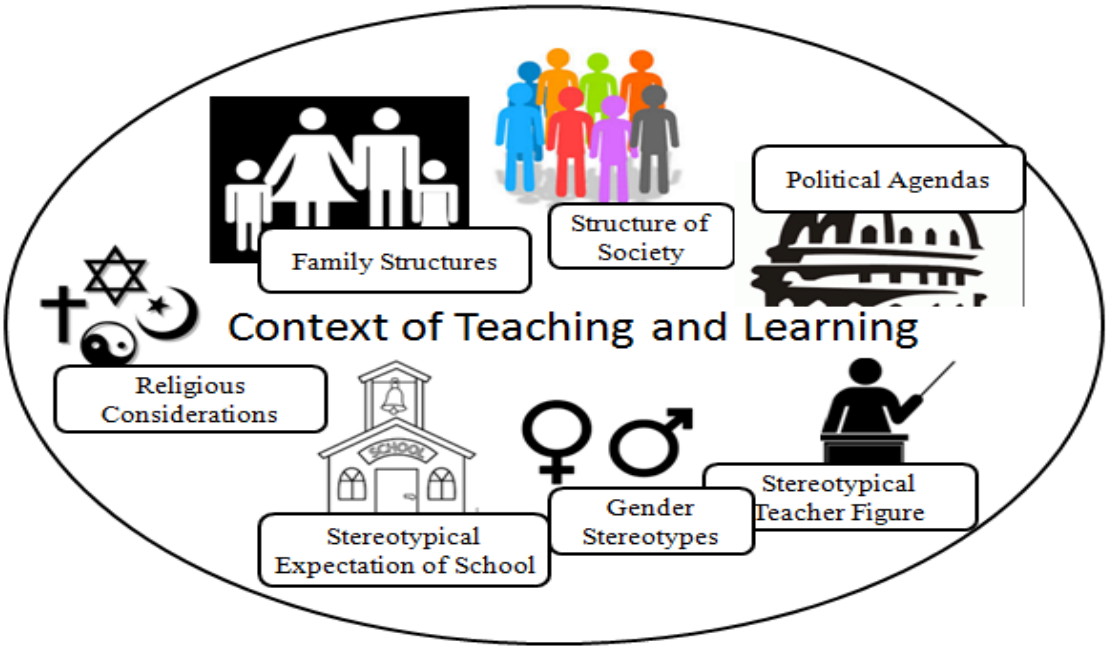

Figure 1.3. Context of Teaching and Learning.

To better understand the factors that affect the context of teaching and learning (Figure 1.3), one can take the example of the western context of teaching and learning. With the growing trend of setting global trends for education, western teaching and learning practices are gaining more popularity even among eastern cultures. This raises a big question of context dependency. Literature (e.g. Stylianides, 2015) indicates that the integration of successful western teaching practices into a different schooling culture does not always yield positive results. Considerations to the context are crucial for the integration of foreign teaching practices to be successful. Figure 1.3 shows some of the contextual factors that generally affect teaching and learning in the formal setting of instruction within a school classroom. The first aspect that affects the means to teaching and learning is the way the school is perceived in the society. Societal values and belief

systems often dictate a certain way of classroom teaching and student learning. Those belief systems sometimes extend to be even differentiating between male and female learners in terms of their learning potential (Ogbu, 1992). Moreover, within each school, a characteristic school culture exists. This school culture is often the product of economic factors, the teaching staff, power dynamics and the vision of the school leading team. This school culture in turn, has certain stereotypical expectations that both teachers and students have to abide by. These expectations often address the teacher's behavior, pedagogy, belief system and philosophy. As a result, the teacher is often cornered in having to abide by stereotypical expectations that could contradict his/her own beliefs (Ernest, 1982). Often also other forms of beliefs having their roots in religion or in family tradition play their roles in penetrating the formal teaching and learning environment (Mansour, EL-Deghaidy, Alshamrani & Aldahmash, 2014).. It is important to mention that the considerations that have been made in Figure 1.3 are mostly considering the context of formal teaching and learning. Other forms of learning will be excluded from the framework of this study.

For this study, it is important to particularly consider the teaching and learning practices of mathematics. Similarly, for the particular case of teaching and learning mathematics, contextual factors need to be taken into consideration. These contextual factors include the perception students have about the nature of mathematics as a subject along with their expectations from the mathematics classroom. Some learning contexts lead students to perceive the study of mathematics as a simple recitation of taught formula. In that model, a good mathematics student is the one who can apply the studied rules to solve exam questions. On the other hand, other learning contexts place their emphasis on learning the skills that lie behind the subject matter. These skills include the ability to continuously inquire and question and the

ability to solve complex problems. Hence, there are many different ways students can experience mathematics. It is therefore crucial to bear in mind that across different contexts the very nature of mathematics knowledge acquisition is different (Picker & Berry, 2015).

1.2. Rationale

Being personally exposed to learning in different contexts, the researcher finds it truly important to differentiate between academic excellence and academic social buy-in from the community. Each culture dictates a certain framework in terms of how people ought to learn. Hence, according to one's own expectation of best practices to teaching and learning, it is often a daunting task to fit into a different knowledge building society that abides by different contextual and cultural values. With the growing trend of a globalised 'one size fits all' schooling model, it is becoming ever more crucial to highlight the role of contextualization. Schooling systems that seemingly fail at adopting the mainstream trend of teaching cannot be completely viewed as lagging behind. Anticipation of global trends needs to still consider the contextual implementation in the locally accepted framework. This study discusses the possibility of abiding to global standards while not losing the local identity. The secret to that paradox lies in thoroughly comprehending the role of culture along with the means to cultural contextualization.

1.3. Theoretical Framework

The theoretical framework of this study is based on the socio-cultural theories developed by Chambers (1983) and Goodenough (1926). It builds on the realization that for education to be effective it needs to consider differentiated forms of pedagogy and instruction. Also, the work of Goodenough (1926) highlights the importance of the role interdisciplinary education. In particular, his work sheds light on the role of drawing to reflect a person's psychological stand. The coming Chapter will more elaborately discuss psychological implications of drawings and

how drawing can be adopted to interpret a person's perception of other fields of study. Furthermore, the framework of this study also builds on the concepts established by Bishop (1988) that argue against wiping out the local identity and strongly emphasize the beauty of diversity and the importance of adopting foreign practices while still abiding to local norms and belief systems.

1.4. Research Question

As presented at the beginning of this Chapter, this study seeks to investigate the role of contextualization of teaching and learning and its impact on a student's perception of a certain subject matter being taught. In particular, this study intends to focus on the Egyptian schooling culture. On the course of that work, the Egyptian learning culture; its beliefs and values will be discussed in more detail. Resulting from that is a manifestation of culturally driven teaching principles.

This study intends to interlink the contextual analysis of the Egyptian learning culture with the study of preparatory school mathematics education (Figure 4). Along the study, the researcher intends to reveal local flavors of the mathematics teaching identity in the Egyptian culture and how it is perceived by students.

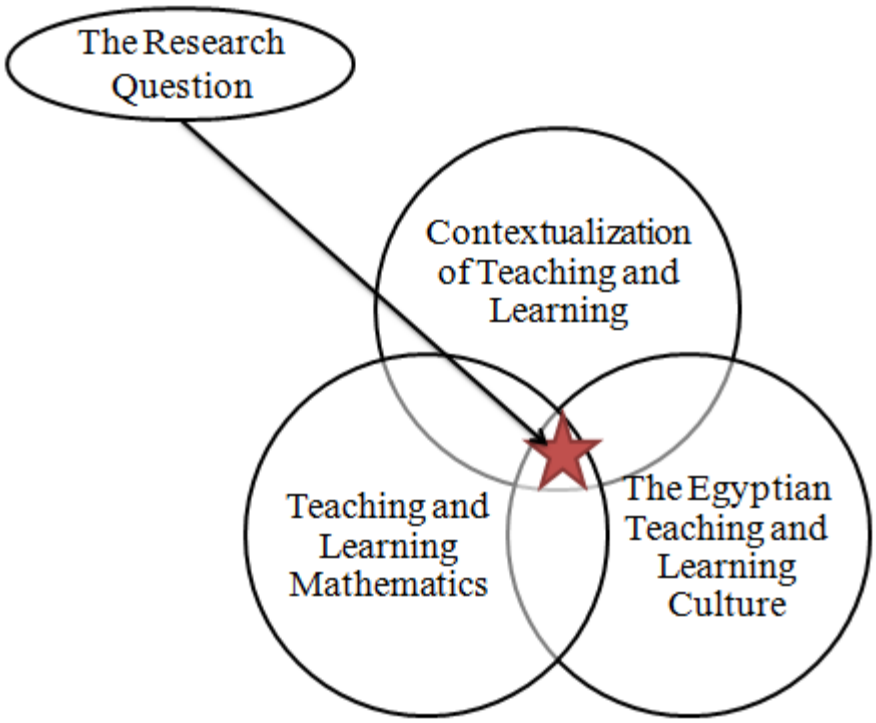

Figure 1.4. Developing the Research Question.

More specifically, the study seeks to explore features that relate to the teacher-student relationship. Building on the principles of Friere (2000), the study seeks to uncover the authority relationship within the classroom.

The research question that this work seeks to address is the following:

What insights about classroom power dynamics in the Egyptian mathematics learning context can be drawn from the analysis of preparatory local school students' drawings?

1.5. Chapter Outline

This study intends to elaborate on the contextual factors that affect the teaching and learning of mathematics in local Egyptian schools. The study starts with an elaborate review of the local Egyptian learning culture along with some considerations of teacher beliefs and self efficacy within the same culture. This takes place in Chapter 2 as part of the literature review. The

Chapter ends with a fine-tuning of the discussed phenomena and the reframing of the research question. Following the second Chapter, the methodology Chapter discusses the means to answering the research question. The philosophy underpinning this work is also developed as part of that Chapter. Chapter 4 addresses more concretely the detailed data gathering and data analysis process. As clear from Figure 1.5; the data analysis follows a series of adopting two consecutive methods. Results of the analysis are then interwoven and summarized. Finally, the study ends with a conclusion in Chapter 5.

Figure 1.5 again summarizes the structure of this work.

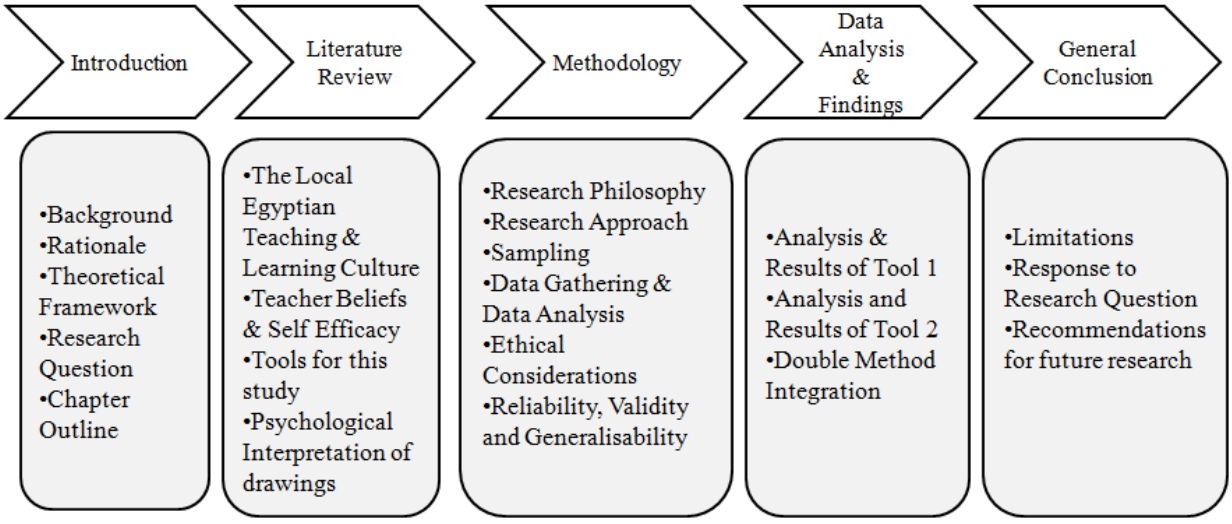

Figure 1.5. Thesis Outline

CHAPTER 2

LITERATURE REVIEW

In each culture there are different forms of schooling and even among formal schooling frameworks, a diverse range of teaching pedagogies exists. Studying the approach to teaching certain subjects, such as history or psychology for instance, one can easily detect patterns that relate to the culture where instruction takes place. Sciences and mathematics, on the other hand, seem to be quite universal. One might argue that a Japanese student studying the concepts of differentiation or the science of thermodynamics will not be any different from an American student studying the same mathematical and scientific principles. Bishop (1988) argues against the universality of mathematics instruction and claims that though the rules of mathematics do not change, yet mathematics instruction ought to adapt to the culture where teaching takes place. Furthermore, Stylianides and Delaney (2011) suggest that the manifestation of teacher knowledge and hence the resulting image reflected to students about mathematics cannot be separated from the cultural context of both student and teacher. In their book, "The Culture of the Mathematics Classroom" (Seeger, Voigt, & Waschescio, 1998), the authors discuss the mathematics classroom culture as well as the means of constructing knowledge and preparing teachers to fit into a specific culture governed by certain social and economic factors. Ruthven (2008) highlights yet another dimension, namely the influence of policy makers on the shaping and development of teaching curricula and researchers' quests. In that respect, it is important to consider the culture of the knowledge economy (Stylianides & Delaney, 2011). Teachers' performance is governed by external audit and evaluation expectations. External audits govern

several pedagogical decisions and contribute to the formation of classroom practice constraints. In addition to that, literature adds to the equation another dimension, namely parents' expectation and satisfaction (Watson, 2014). According to Watson (2014), parents count as one of the main stakeholders in any school education system and hence the adopted teaching strategy needs to be to their satisfaction. If the parents are for example very much assessment driven and only measure their children's performance by their final grades on exams, then teachers are often forced to adopt a learning culture that is centered around passing the test rather than centered around daily learning activities. Watson (2014) carries on to point out, that both teacher instruction and student learning are assessment driven. For teachers, it is important to cover material that is relevant to the test. This might in some cases imply adopting a certain teaching strategy that fits with the general requirements of the examination culture. A teacher who strongly believes in project based instruction may not be able to adopt this pedagogy if the assessment methodology that s/he is required to attend to is mostly concentrated around individual progress monitoring. Furthermore, Supovitz and Turner (2000) suggest that classroom culture is also strongly linked with teacher background throughout his/her professional development program. According to the authors (Supovitz & Turner, 2000), in contrast to school policy changes and curriculum variations, teacher culture most strongly regulates the classroom culture. This means that teachers usually adopt a pedagogy that they personally are familiar with or particularly fond of. Quite often, the chosen pedagogy is the same pedagogy that the teacher himself/herself has experienced as a student (Miele, 2001).

It can hence be deduced that the wide spectrum of a mathematics teaching pedagogy ranging from teacher centered methods (Watson, 2013) all the way to a student centered collaborative classroom (Watson, 2014) is not a mere teacher's choice but rather an interplay

between policy makers' intentions, culturally accepted models and values and imposed social and economic expectations. Figure 2.1 again briefly illustrates the factors that influence the classroom culture.

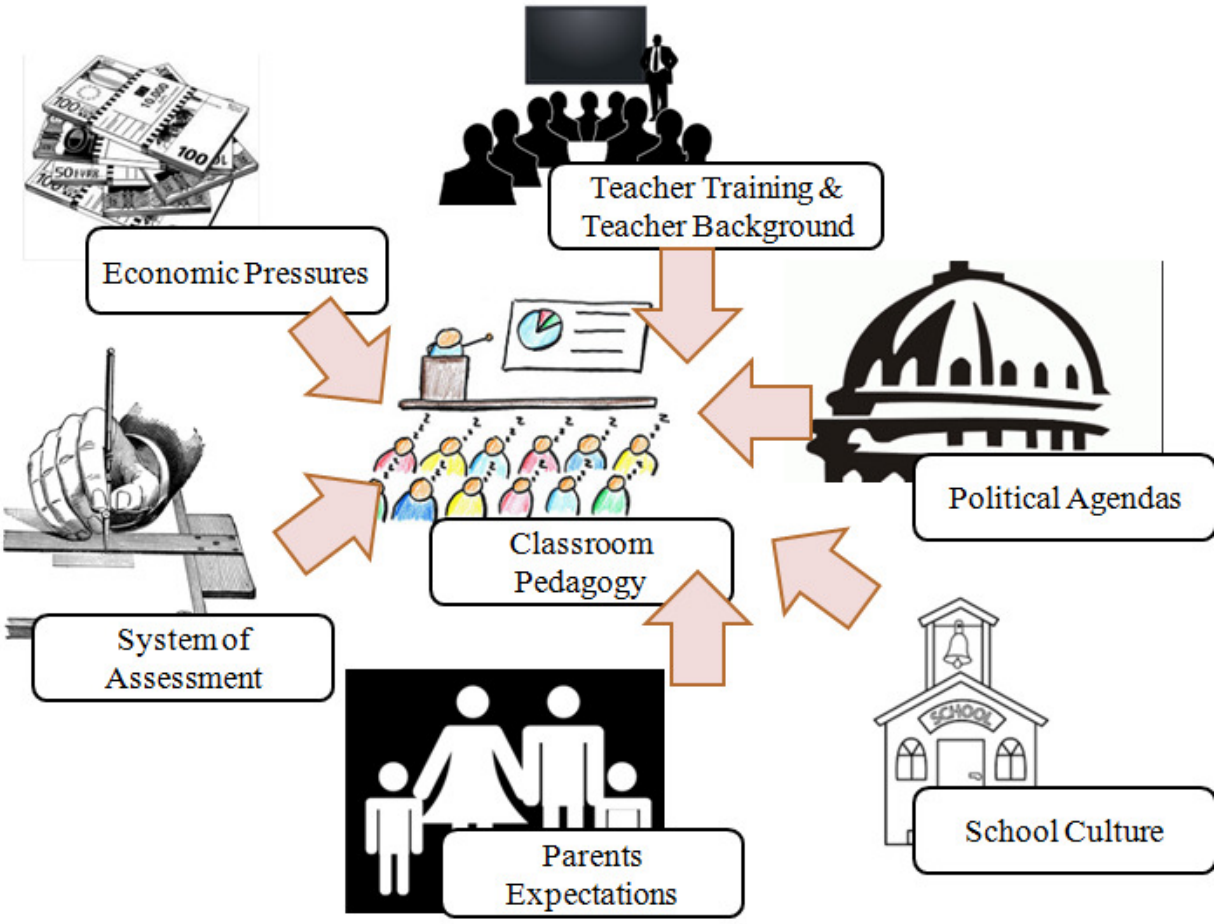

Figure 2.1. Contextualization of Classroom Pedagogy.

As indicated, Figure 2.1 illustrates all the discussed influences, highlighting that classroom pedagogy is a product of political, social, economic factors. The figure also shows that pedagogy to be mirroring teacher philosophy and background as well as the school culture and belief system (Supovitz & Turner, 2000). In addition to that it is also driven by the assessment methodology that both teacher and student often perceive as their only means to illustrating their

performance. This is in line with Engestrom's (1999) findings that an individual entity cannot be considered in isolation of their social culture. In his well-known activity theory, Engestrom (1999) relates individual behavior along with collective societal behavior to the culture wherein these behaviors take place. In other words, Engestrom (1999) argues that it is difficult to understand the individual's action without considering his or her cultural context. Similarly, it is also difficult to understand the society without deeply assessing the cultural influences on the individuals within this society. Hence, products or artifacts of these individuals are strongly influenced by the culture where production took place. The teaching approach that the teacher decides to adopt cannot be understood in isolation of the overall school culture, stakeholder pressure, teacher preparation along with other factors. There is thus interrelatedness between classroom activities and other factors external to the classroom. Furthermore, a teacher is governed by certain rules and instruments that s/he has to make use of in class.

Figure 2.2 shows a more elaborate description of the Engestrom's (1999) activity theory.

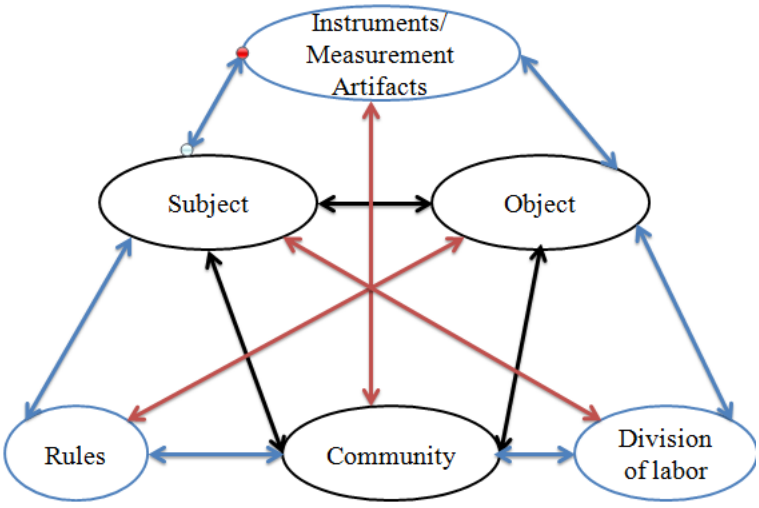

Figure 2.2. Activity Theory. (Engestrom, 1999)

As illustrated, the subject (in this case, the teacher) is governed by rules that enable him/her to be an active member of the school community and is also governed by tools that dictate his/her production. Objects (in this case the classroom pedagogy), on the other hand are created through a system that joins those individuals together by division of labor. The culture of the community both dictates the rules individuals should follow and how this labor division would take place. Instruments are also culturally driven. This means that the tools and the way to produce objects change according to the community where this production takes place.

Now that the general framework of a context driven pedagogy has been laid forward, it is important to narrow down the focus to clearly shed light on matters that will be particularly important for this study. This work presents a contextualization study of students' perceptions of mathematics within the local Egyptian learning culture. In order to better understand the contextual factors that affect the teaching and learning of mathematics in Egyptian local schools, this Chapter will be divided in the following sections:

- The first section will be developing the underpinning theoretical framework of this study. Being a contextual study, much of the analysis builds on the foundations of the social cognitive theory. In addition to that, many features of the analysis can only be explained when considering the impact of socio-cultural factors.
- The second section will be presenting the particular context of this study, namely the local Egyptian Learning Culture particularly focusing on the teaching and learning of mathematics. This section will also be contrasting two learning cultures that are strongly present in the Egyptian teaching and learning society.
- The third section will be focusing on preliminary presenting the tool that has been chosen for the analysis of this work. More focus on the tool will also follow in Chapter 3.

This tool makes use of the interdisciplinary concepts that challenge students to demonstrate their perception of mathematics in the form of arts.

- In order to deeper comprehend the medium of arts as a tool for self expression, the fourth section will be presenting literature that offers some psychological interpretations of drawings.

Finally the Chapter ends with a brief summary of the aforementioned four subsections.

2.1. The Social Learning Theory

While much of today's research in the field of education primarily focuses on the principles of teacher self-efficacy in order to explain a teacher's behavior and philosophy in certain situations (Watson, 2013); this study considers the overarching broader framework of the Social Learning Theory, out of which teacher self-efficacy is only one component.

The Social Learning Theory integrates two very important principles, namely the cognitive and the societal aspects of learning (Bandura , 1977). As already mentioned, both of these principles are inseparable and constitute the foundations of the upcoming contextual analysis. The cognitive aspects of learning include – but are not limited to – the notions of teacher beliefs and the notions of teacher knowledge. The social aspects, on the other hand, expand on teacher participation and social interaction with the students, with other teachers and with the school policy. In addition to that, they also explore some societal barriers to the adoption of certain pedagogical techniques. The question of stakeholder buy-in is vital to that aspect of the social learning theory (Lave & Wenger, 1991). Figure 2.3 shows the twofold theoretical framework of the social cognitive theory.

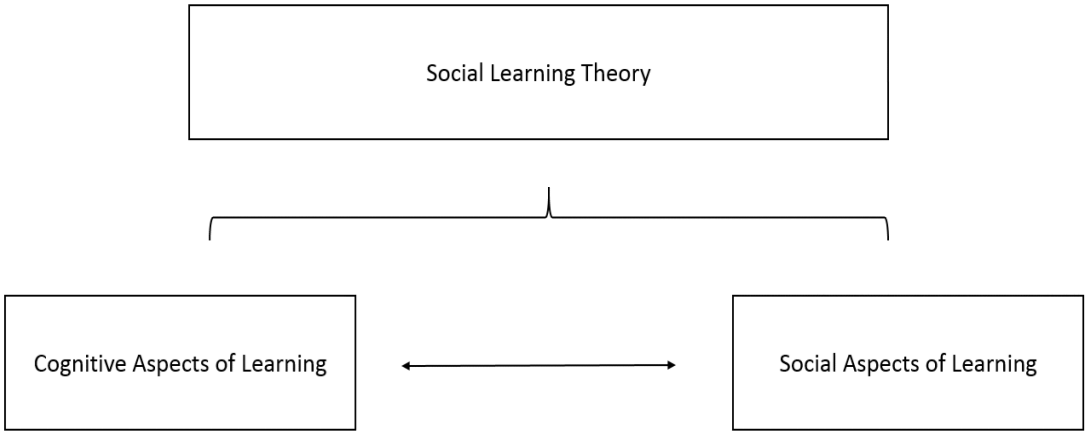

Figure 2.3. Theoretical Framework of the Social Learning Theory.

In his work on the Social Learning Theory, Bandura (1977) points out that much of the individual knowledge, beliefs and behavior results of continuous observation of other people's practices. This does not imply a simplistic direct imitation of other people's behaviors. Instead, Bandura (1977) points out, that the creation of a mental model of how an ideal classroom session ought to be held is a product of direct and indirect observation. In other words, a novice teacher keeps observing how other more experienced teachers are holding their sessions. While observing, the teacher catches some features that s/he likes or dislikes. Based on the context where this observation takes place, the teacher starts to form an impression of how his/her sessions need to be structured. This impression is coupled with anticipated beliefs of the teacher's own perceptions of best practices to teaching. In brief, the accumulation of sophisticated mental models through observation results in the construction of personal beliefs that later are practiced in the form of behaviors (Watson, 2013). This is presented again in Figure 2.4.

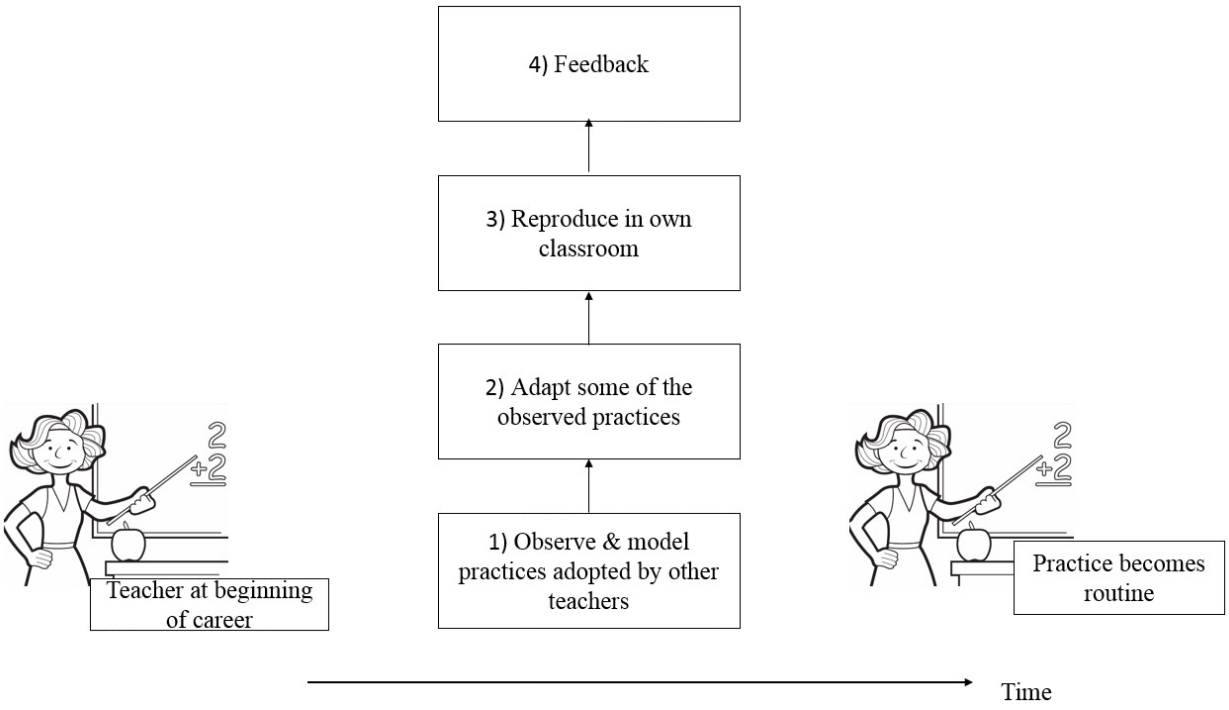

Figure 2.4. Stages of Teacher Contextual Observation.

Figure 2.4 again summarizes the series of steps that lead to the development of teaching practices based on observation. The extent to which a teacher believes in the success of a particular course of action in a given context strongly influences the way this teacher would decide to formulate his/her own beliefs about teaching. Each teacher has therefore a set of principles that s/he believes to be yielding the best results. The dwelling on those believes and the continuous practice of those leads to the teacher self-efficacy which will be dealt with in more detail in the coming subsection.

The danger in adopting the model in Figure 2.4 is that it offers a false sense of stability in terms of teaching practices. A teacher feels safe in adapting to the already existing beliefs and practices in the particular context where teaching takes place. This sense of security often does not allow for the freedom of innovating new means in terms of student pedagogy. Figure 2.5

shows the conflict that happens when attempting to innovate and change existing principles to teaching and learning.

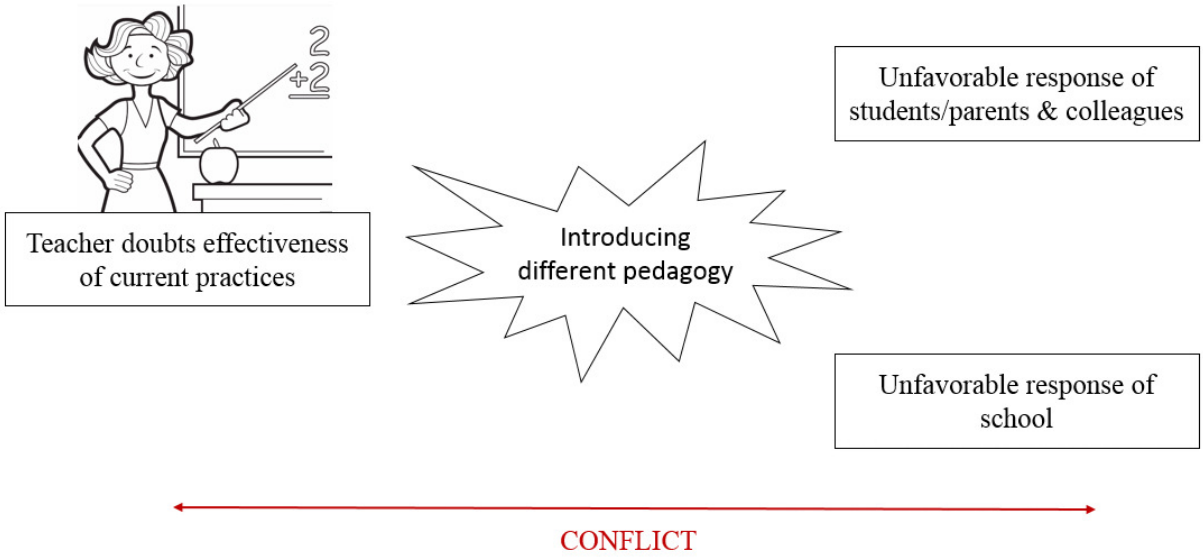

Figure 2.5. The Conflict.

Figure 2.5 illustrates the conflict that happens when a teacher decides to break out of the norm and adopt a pedagogy that is different to the one that s/he has observed from more senior teachers. When the adopted innovation is foreign to the school culture, then often the decision whether or not to keep on persisting is a question of teacher beliefs and self-efficacy. These are presented in the following subsection.

2.1.1. Teacher Beliefs and Teacher Self Efficacy

As previously mentioned, a deeper focus on some concepts of the social cognitive theory can offer some explanation to the reason behind preferring to adopt some teaching values in the Egyptian teaching and learning society.

According to the principles of the social cognitive theory, a teacher's classroom performance is a product of several factors, some of which include; the teacher's self efficacy and belief system and practices. Research (e.g. Mansour, 2009) shows that teacher's beliefs strongly impact their every day planning decisions as well as their classroom practices. Generally, teachers' beliefs about classroom instruction stretch along the continuum illustrated in Figure 2.6. This continuum stretches between two extremes, ranging from the behaviorist model at one end and the constructivist at the other end.

Figure 2.6. Teacher Beliefs Spectrum.

The behaviorist approach to teaching follows a system of transmission where the teacher is viewed as the active transmitter of knowledge and the student as the passive receiver. At the other end of the spectrum, the constructive approach to teaching mathematics is a system of continuous inquiry and questioning. As aforementioned, the position of the teacher's beliefs on the above spectrum is mirrored in his/her everyday teaching practices. Resulting from that is an overall system of classroom strategies, curriculum formulation and assessment methodology. Becoming a traditional or a progressive teacher is a product of several factors, one of which includes the teacher's personal experience in school as a student (Mansour, EL-Deghaidy, Alshamrani, & Aldahmash, 2014). It is nevertheless true, that teacher's beliefs cannot be viewed in isolation from the wider cultural framework where teaching takes place. In other words,

contextual factors strongly govern the extent to which a teacher finds freedom to practice his/her own beliefs in a classroom (Mansour, 2009). Some of those contextual factors are depicted in Figure 2.7. Mansour (2009) argues that the system of assessment, the overall national system of schooling, the impact of peer teachers, supervisors, students, parents and school policies cannot be isolated from a wider contextual understanding of a single teacher's classroom practices.

Furthermore, other constrains such as classroom time, class size, availability of teaching equipment, administrative logistical settings such as scheduling and the pressure of external examination models also affects a teacher's choice to adopt a certain belief as part of his/her teaching (Mansour, 2009). Hence a complete understanding of classroom practices is not possible without shedding light on the wider contextual framework.

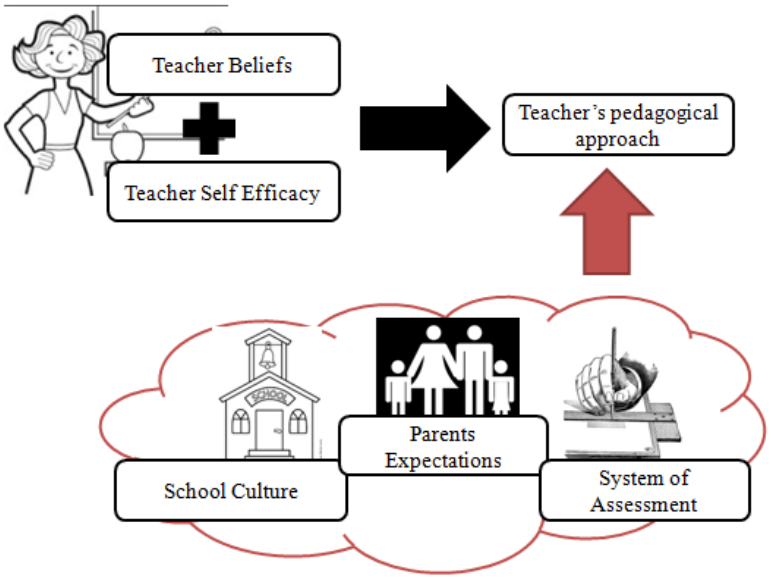

Figure 2.7. Internal and External Factors.

In addition to the importance of contextualizing teacher beliefs, it is also important to contextualize the impact of teacher background in terms of training. Mansour et al.(2014) argue

that teacher development programs need to take social, cultural and political factors into consideration in order to be effective. In other words, this speaks against the universality of teacher training. For teacher preparation to be effective it needs to consider the context and setting where the teacher will be adopting the developed concepts. This is also highlighted in Figure 2.7. Due to external pressures (such as the school policy, the examination culture etc.) a teacher's classroom practices are not always mirroring their teaching beliefs. Funding agencies, school policies and general policies very often force teachers to acquire a set of teaching practices that are not in line with their own beliefs (El-Deghaidy, 2006).

2.1.2. Five unproductive Learning Climates

Cornbleth (2001) distinguishes five different unproductive climates where instruction can take place and argues that both students' perceptions and understanding as well as teachers' practices and self efficacy are highly dependent on the climate of the session where instruction is taking place. These five climates are the following:

- A *bureaucratic climate* where there is a high emphasis on school regulations and a strict discipline requires the following of orders. In this system, students often find themselves oppressed. They don't have much of a choice. Teachers tend to become more authoritarian. Negotiation and debate are perceived as improper.
- A *conservative climate* where change is not encouraged and where it is more important for students and teachers to simply maintain the current status of the school. This is quite common in schools that have a long history. Change is perceived as a threat as the school usually is keen on keeping its reputation.

- A *threatening climate* where curriculum formation happens external to the school. School policies are also subject to continuous iteration depending on the iterations of globally set teaching and learning standard practices. In addition to that, examinations are usually not tailored to fit the needs of the students but are rather set according to global criteria that generally would be used for comparative purposes. External Censorship is also very popular in this type of climate.
- A *climate of pedagogical pessimism* where teachers are mostly complaining of the school system, the parents as well as the student performance. As a result students are usually very discouraged. They rarely find chances to innovate and be creative.
- A *competitive climate* that is dominated by comparisons of rankings. In this system, students' main concern is about their ranking and where they stand in comparison to their peers. This system usually diminishes the value of peer work. In addition to that there is minimal focus on daily learning and development. Instead the main focus is on the final grade.

The case of Egypt is particularly unique. Within the same country there are two extreme tracks of teaching practices and school pedagogies, one of which is following a rather more traditional didactic approach while the other is more open to innovation and problem solving. The local schools adopt a rather more traditional, teacher centered approach (El-Deghaidy, 2006; Little, 1993). In contrast to that, a wide range of international skills are expected to be following the global, inquiry based trend (Liebermann, 1995). The next section will be presenting both cultures in more detail.

2.2. The contrast in Egypt's Learning Cultures

As aforementioned, the case of Egypt is particularly unique with regards to the diverse distribution of teaching and learning cultures among various schooling models within the same country. Over the past twenty years, there is a growing movement towards globally unifying teaching and assessment standards (Forsey, Davies & Walford, 2008). In response to that, many of Egypt's elite schools have been taking the lead in introducing international standards for teacher recruitment, curriculum formulation and assessment.

It is however important to distinguish between globalization of education and internationalization of education (Kress, 1996) with the latter meaning introducing unified international standards while respecting the differentiated implementation of those same standards. This difference in implementations is a direct result of the varying cultural contextual factors in each learning environment. In other words, the setting of global trends needs to consider not wiping out the value of the local trends of every society and culture.

The next sections will be presenting and contrasting in more detail the local and the international trends of education in Egyptian schools.

2.2.1. The Local Learning Culture in Egypt

In his work about teacher development Hodgson (1986, p.29) argues that: " Most teachers hold degrees in education, psychology and related technical fields; few people have been [officially] trained as historians, scientists [or] philosophers. Even those who do hold liberal arts and science undergraduate degrees rarely continued their pursuit of these subjects".

This statement is particularly true for teachers in the local educational system in Egypt. Indeed, mathematics teachers are viewed as technicians rather than individuals (Little, 1993) who are not expected to be engaged in questioning or in the process of knowledge building

(Liebermann, 1995) and hence do not need any form of deep subject knowledge training. It is therefore not surprising that schools and local districts are only inclined to conduct teacher development training as a bureaucratic measure in order to include their involvement with teacher training in their records (Little, 1993). The teacher training usually follows a set framework that is designed in a one size fits all fashion (Liebermann, 1995; Little, 1993). It does not include hands on activities (Hargreaves, 1997; Little, 1993). Rather than equipping the teacher with a diverse skill set to assist in differentiated knowledge delivery, teacher development programs simply stress on revising the existing information in the teacher's repertoire of knowledge (Little, 1993). Having had no prior experience as a student in an inquiry based classroom, teachers tend to base their values on established traditional beliefs about best practices. It is difficult to drift away from adopting the methods they were used to as students (Miele, 2001). The teaching of mathematics is therefore teacher centered with much emphasis on memorization and little room available for student contribution. The teaching follows a text book centered approach where the teacher is directly transmitting information and students are simply requested to digest the data provided by the teacher. Among the students, there is often much competition as the final grade is more emphasized on the final result rather than the actual process of inquiry. The process of knowledge construction is substituted by knowledge consumption from the student's side. (EL-Deghaidy, 2006; Liebermann, 1995; Little, 1993). The mentioned characteristics are in line with Friere and Bergman's (1986) analysis of oppressor-oppressed relationship. The authors describe a traditional relationship between teacher and student where education is perceived as a banking system. The teacher is considered to have all the knowledge and to deposit this knowledge into the apparent empty student's mind. While

transferring knowledge, the teacher retains control and the student is expected to be a passive listener not engaging in any form of dialogue.

2.2.2. The International Learning Culture in Egypt

Supovitz and Turner (2000) report that students in the international schooling system are viewed as active participants that need to be continuously questioning, experimenting and solving problems. As opposed to the textbook centered model, this strategy seeks to equip students with analysis and evaluation skills that are useful even beyond the classroom framework (Liebermann, 1995; Supovitz & Turner, 2000). Teachers and staff are equipped with a set of complex skills and strategies that enable them to be key players and not simply followers of an overall system. Teacher development programs encourage the pursuit of a deeper knowledge of the subject matter in order to cater for a more challenging knowledge building classroom atmosphere (Supovitz & Turner, 2000). Collaborations among faculty, administration and subject matter experts is very important.

Staff development does not take place in isolation of everyday teaching and teachers are encouraged to share their everyday struggles and challenges (Liebermann, 1995; Supovitz & Turner, 2000). For this to be possible mutual agreement between the school culture of inquiry and the teaching team culture needs to be present. Without insuring the buy in from all stakeholders and without a unified vision on both sides, the implementation of a problem posing method in mathematics would be impossible to achieve (Supovitz & Turner, 2000).

Similar to the previously outlined analogy, this education strategy has been categorized by Friere and Bergman (1986) to be empowering to students as it allows room for dialogue. The emphasis is on the process of inquiry rather than the product. This system offers space for problem posing.

Table 2.1 summarizes some of the main features of Local School Learning Culture in contrast to the International School Learning Culture in Egypt.

Table 2.1

The Local & International School Cultures in Egypt

	Local Teaching Culture	International Teaching Culture
Teaching Strategy	The approach is mostly teacher centered with the text book as the core instruction medium. Knowledge acquisition happens through direct transmission of information between teacher and student. Student participation is not seen as necessary and recitation of studied material is the popular means to assess knowledge.	The approach is mostly student centered, with inquiry and experimentation at the heart of the teaching strategy. The students construct knowledge together with their peers. Dialogue is encouraged and learning is assessed by presenting students with challenges and problems to solve.
Teacher Development	Development programs take place to fulfill a bureaucratic requirement. Minimal hands on training is presented and the development sessions follow a one size fits all concept with minimal differentiation. The teacher is perceived as a technician. Teacher development material is developed in isolation from teacher's everyday struggles and needs.	Training sessions are contextualized to fit with teacher needs and everyday classroom experiences. Teacher development takes on various forms ranging from workshops to counseling sessions and classroom simulations. Collaboration and knowledge exchange among teachers is encouraged. The teacher is perceived as an intellectual.
Schooling System Applicable in Egypt at	Banking System Local Schools	Problem Pausing System International Schools

As clearly presented in Table 2.1, the teaching values that are of importance for this work are those that can be affected by the context. According to literature (e.g. Bishop, 1988), teacher values, self efficacy and beliefs have their routes in the culture where instruction is taking place. This is why it is important to present the background of teacher development in the local

Egyptian culture. Furthermore, also as mentioned, Freire (2000) distinguishes between two schooling systems; namely the problem posing system and the banking system. In the problem posing system, students develop their knowledge about a certain subject matter through continuous inquiry and questioning. The banking system, on the other hand, views students as passive recipients of knowledge and places the full responsibility of knowledge transfer on the teacher.

Table 2.1 seeks to hence contrast the different cultures of teaching and learning in both schooling models. For the purposes of this work, the manifestation of teaching practices of mathematics will be studied within the local schooling culture only. Due to time constraints, it was not possible to present a comprehensive comparative study. Nevertheless, future work can adopt the same pattern of analysis adopted in this study and apply it on international schools in Egypt for the sake of comparison.

2.3. The Research Tool

After thoroughly discussing internal and external factors that affect the classroom pedagogy in general and the mathematics classroom in particular, the next step is to turn our attention to detect traces of the students' perceptions of the aforementioned frameworks and pedagogies. As already mentioned, this work intends to highlight students' perceptions of mathematics within the local Egyptian learning culture**.** In order to trace student perceptions, an interlink between two analysis tools will be necessary. These tools are both based on students' self expression in the form of drawing. The first tool is the "Draw a Science Teacher Test Checklist" also referred to as the DASTT_C and the second tool is the "Draw a Mathematics Teacher Test" also referred to as the DAMT. While the first tool generally depicts traces of teacher vs. student centered pedagogies, the second tool is more oriented towards assessing power dynamics in mathematics

classrooms in particular. Both tools are applications that stem from one study, namely the "Draw a Scientist Test", also referred to as the DAST. A brief description of the DAST method as well as a presentation of both sub-tools that are relevant to this study will be discussed in the following subsection. Afterwards, the interlink of both sub-tools will be presented. More in depth details about each tool's utilization and the two tools' integration is also available in Chapter 3.

2.4. The DAST Analysis Tool

In 1926, Florence Goodenough suggested a methodology to measure a person's intelligence by drawing (Goodenough, 1926). The idea behind the preliminary (DAP) Draw a Person Test was later adopted by Chambers (1983). Chambers (1983) intended to basically breakdown students perceptions of sciences into stereotypical and alternative images (Farland-Smith, 2003). Thus, the Draw a Scientist Test (DAST) was first developed. Students were asked to draw a scientist and the drawings were checked against seven initial stereotypical factors. The occurrence of these factor elements in the drawings would highlight the degree to which students' views of scientists is based on social stigma and stereotypes (Picker & Berry, 2015). These seven factors were (Chambers, 1983):

- A white lab coat
- Eye glasses
- Facial hair
- Symbols of research
- Scientific Instruments
- Symbols of knowledge such as books or other resources.

Chamber's (1983) DAST was later modified to include a checklist to score the drawings against. This modification was meant to add some quantifiable accuracy to the original test (Finson,

Beaver & Cramond, 1995). Also some additional features were added to the existing list (Picker & Berry, 2015). These included the gender biased stigma of depicting a male figure as a scientist rather than a female figure, the presence of some indicators of danger in the science lab and the notion that scientists' work is mostly are associated with indoor activities. The modified version was called 'Draw a Scientist Test_Checklist' (DAST_C) (Finson et al., 1995).

2.4.1. Validity and Reliability of DAST_C

For the above mentioned methodology to be applicable in scientific work, it has to pass through the checkpoints of validity and reliability. Along with other scholars (Miele, 2001), Farland-Smith (2003) has conducted extensive research in that area and has concluded that the scoring system of the DAST_C provides a high degree of validity primarily because the characteristics of the checklist were derived from extensive previous research about social stereotypes and their associations with sciences along with a wide range of interviews with students and teachers who took part in those tests. Secondly, the checklist is also inspired by the criteria developed by the National Science Education Standards (NSES) and the data resulting from the DAST_C is widely used as part of the National Research Council (NRC) Research tools. Adding extra features to the original seven stereotypical images thus provides a wider lens of analysis that goes beyond the obvious. Furthermore, the test has also been complemented with a section where students are asked to verbalize their drawing in order to better put the drawing into context and narrow down the possibility of judging an image incorrectly.

Medina-jerez, Middleton and Orihuela-rabaza (2011) also highlights that over the years there has been a very high degree of consistency of those results which again advocates for the reliability of the test. Farland-Smith (2003) suggests that reliability of the results can further be developed if two independent raters are asked to rate the images. This will be taken into

consideration to ensure reliable results of this work. More details that relate to the reliability of this study will be discussed in the next Chapter.

2.4.2. Why adopt DAST

The DAST has been mostly used in research to accomplish one of 4 main goals (Miele, 2001) :

- A post teacher training course evaluation tool to identify the extent to which science teachers' perception of scientists has changed and in how far they can confidently perceive themselves as scientists.
- To aid current and future teachers to examine and constantly re-examine their beliefs about learning and teaching over the years.
- To reveal common stereotypes of scientists that many people have and to unveil the influence of those stereotypes on teaching and learning.
- To provide a foundation for data gathering in inquiry based science projects.

It is this latter goal that this work will be adopting. Further details about some changes that have been made to fit the purposes of this study as well as a detailed explanation of the chosen methodology and how it related to the objective of the study will be available in Chapter 3.

2.4.3. Some Applications

In the previous sections, the DAST method has been presented along with the checklist developed to better quantify the results. Considerations of validity and reliability have also been dealt with and the general goals to adopting this model have also been discussed.

Over the years, several researchers have adapted this model in order to better fit with their research questions. Two of those applications are of particular importance to this study and will be presented in the coming sections.

2.4.3.1. Draw a Science Teacher Test Checklist (DASTT_C)

Of particular interest to my study, is the work developed by Thomas, Pedersen and Finson (2001). Together they adapted the DAST model to particularly address science teachers. In their work 'Draw a Science Teacher Test Checklist' (DASTT_C), Thomas et al. (2001) intend to shed light on the pedagogy of science teaching. They distinguish between two approaches; the teacher centered and the student centered approach. In the teacher centered approach, the teacher is at the center of instruction and is perceived as the owner of knowledge. Students' contributions are encouraged but are neither expected nor seen as necessary as the teacher has a set curriculum of learning objectives that s/he needs to have gone through in a certain time frame (Thomas et al., 2001). The student centered approach, on the other hand views the teacher as a facilitator and builds on the fact that knowledge construction mostly comes from the student body. Students are responsible for their own progress and their pace of learning. Hence, student inquiry and participation is vital to the success of this method (Thomas et al., 2001).

In the original DASTT_C pre-service science teachers were asked to "draw a picture of [themselves] as a science teacher at work" (Thomas et al., 2001,p.308). They were also asked to write a short narrative to further explain teacher and student activities in their drawings. The drawings were measured against given criteria and were hence placed on a student-teacher centered continuum. Table 2.2 shows the exact way of scoring the students' drawings.

Table 2.2

DASTT_C Measurement Criteria

Element	Criteria	Feature
Teacher	Activity	Demonstrating Experiment
		Lecturing
		Visual Aid
	Position	Centrally Located
		Standing
Student	Activity	Watching & Listening
		Responding to Questions
	Position	Seated
Environment	Student Desk Arrangement	
	Location of Teacher Desk	
	Symbols of Teaching	
	Lack of Group Work Signs	

(adapted from the work of (Thomas et al., 2001))

As it is clear from Table 2.2, the authors (Thomas et al., 2001) have placed 13 criteria to check the extent to which a student's response to a drawing prompt is descriptive of the science classroom pedagogy. Based on the analysis of those drawings a high score would indicate traces of a teacher centered classroom. A low score on the other hand will place the instruction methodology on the other end of the teacher vs. a student centered continuum. Drawings that illustrate the teacher to be standing at the centre of the classroom giving instructions, or teaching or showing a presentation while students are seated on their desks listening would score high for teacher centered. On the other hand, if the students have the freedom to move freely and are at the centre of the classroom explaining to each other and together constructing knowledge, then this figure would be rather more student centered. In addition to that, the authors (Thomas et al., 2001) added additional features to the classroom environment, such as the way the students are seated, the position of the teacher with respect to the students as well as the teaching tools

adopted by the teacher. At this point, it is worth mentioning, that there is no right or wrong approach to teaching but that rather the discussed measurement are simple tools to measure the perception of pre-service science teachers of themselves (Thomas et al., 2001).

2.4.3.2. Draw a Mathematician Test (DAMT)

Similar to the work developed by Chambers (1983), in order to analyze stereotypical imageries of scientists, Picker and Berry (2015) have developed a prompt to investigate and analyze students' conceptions about mathematicians. The task given to the students was twofold. Firstly, students were asked to draw and write a short narrative in response to the following prompt : "Draw your perception of a mathematician" (Picker & Berry, 2015,p.66). Secondly, students were asked to answer in writing the following question: "If you have a leaky tap or faucet, you need to hire a plumber; if you break your leg you need the services of a doctor. List below all the reasons you can think of for which someone would need to hire a mathematician." (Picker & Berry, 2015,p.67). Both tasks intend to unveil hidden stereotypes that students have about mathematics as a subject and mathematicians as practitioners. The results show that most students have a very narrow perception of mathematics. Most perceptions of mathematics as a subject do not extend beyond dealing with arithmetic problems. Similarly, many students showed difficulty to respond to the role of mathematicians in society. Many students said they were not sure why mathematicians were needed or who would be classified as a mathematician. A very big majority of students would associate mathematicians with mathematics tutors. They fail to view mathematicians as taking on other roles in society. Results of the drawing task show that students' perceptions lie either in one or in an intersection of the following seven sectors (Figure 2.8).

<table>
<tr><td rowspan="2">Mathematics as coercion</td><td>The Mathematician who can't teach</td><td>The Mathematician with special powers</td></tr>
<tr><td>The foolish Mathematician</td><td rowspan="2">Disparagement of Mathematicians</td></tr>
<tr><td>The overwrought Mathematician</td><td>The Einstein Effect</td></tr>
</table>

Figure 2.8. Results of DAMT.

(adapted from the work of Picker & Berry, 2015)

As illustrated in the above matrix, some students perceive mathematicians as teachers using forms of violence, intimidation and threat to highlight wrong answers (mathematics ass coercion). Others view mathematicians as people who are constantly overstrained and wild and who lack a certain sense of balance (the overwrought mathematician). Again other students believe that good mathematicians are incapable of expressing their understanding and therefore can never become good teachers. Also, many view mathematicians as people who lack basic common sense and who are dressed in old fashioned clothes (the foolish mathematician). Because many students feel inferior and intimidated in the mathematics classroom, they resort to the fact that mathematics might just be for a chosen few. This perception is mirrored in their drawings (The Einstein Effect). Others that have the same fears depict people who can solve mathematics equations as having special powers. Finally many students depict mathematicians as being unsocial people (the disparagement of mathematicians).

Two other crucial factors that were highlighted by the authors (Picker & Berry, 2015) and that relate to previous work (Thomas et al., 2001) are the issue of power dynamics in the

classroom and the question of whether mathematics instruction is viewed as a process or as a product.

In the authors' (Picker & Berry, 2015) opinion, the appearance of violent images or the depiction of mathematicians as foolish people is a simple reflection of the students' inferiority. The unfair power balance where the mathematics teacher hordes all the power of knowledge to himself results in a form of teacher dominance in the classroom. Hence students often feel distanced from the subject matter and intimidated to participate.

The second question relates to the matter of mathematics instruction being focused on wrong and right answers, i.e. whether or not mathematics as a subject can be views as a mere substance where the teacher illustrates solution steps and the students are simply asked to follow the steps and come up with the right answers as opposed to viewing mathematics instruction as a process of inquiry where the core focus is on students' continual challenge to solve open problems.

For the sake of the upcoming analysis, both the DAMT and the DASTT_C tool have been combined to ensure the yielding of more prominent results. The first tool will be used to generally measure the degree of teacher vs. student centeredness in the classroom. The second tool will be used to further refine the analysis to particularly focus on the mathematics classroom and to further validate the findings of the first tool with regards to the power dynamics. The next section will offer further elaboration on why the medium of drawing in particular has been chosen for the analysis of this work.

2.5. The Psychological Interpretations of Drawings

As already mentioned, the method that I choose to adopt for my analysis is based on the work of Finson (2002), namely, the 'Draw a Scientist Test' (DAST) method. Students will use drawing as a medium to express their perception of their classroom experience.

Given the fact that the accuracy of unbiased data gathered from Egyptian minor students is difficult to achieve if it takes the traditional form of obvious questioning, interviewing or filling out surveys, it was decided for this study that drawing offers an unbiased and somewhat indirect platform. In his analysis of the psychological interpretation of children's drawings, Goodenough (1929) underscores that minors do not draw what they see but that instead there is a hidden thinking process behind their drawings making them only depict aspects that are of importance to them. For instance, a young person that is asked to draw a certain scene would draw only the main players of the scene and would omit what s/he believes to be insignificant. This is contrary to older people's drawings that would rather illustrate the scene just as it is, presenting all of the details. Hence youngsters' drawings highlight the significant difference between knowledge of facts and appreciation of their importance.

Furthermore, Goodenough (1929) argues that drawing is the primary language for minors and is a good form of free expression that is unbiased. There is generally a close relationship between their perception of matters, power struggles and general processes and their expression in the form of drawings. My study is mostly focusing on extracting data from teenage students. In accordance with Goodenough (1929), providing youngsters with a platform of drawing to express their perception of classroom instruction will allow them to voice out matters they perceive as essential while maybe giving little importance to other classroom related activities.

Students, who feel intimidated or threatened by the teacher are more likely to express those emotions in the form of drawing rather than utilizing other possible platforms such as writing or talking. Hence this platform has been validated to yield more accurate results especially when the participants are in the mentioned age group.

2.6. Summary of the Chapter

This Chapter has presented the main framework of the study which is centered around the principle of cultural contextualization of mathematics instruction. More specifically, contextual factors that affect teaching and learning environments have been discussed. This comes along with an elaborate explanation of the impact of teacher self efficacy and teacher beliefs on the formation of the classroom culture. For the sake of this study, the analysis will focus on the mathematics classroom. Student perceptions of the mathematics instruction pedagogy they are subjected to in their local educational context will be measured by the use of an integration of two analysis tools. Both of these tools are based on the work developed by Champers (1987). The study hence aims to answer the following question: What insights about classroom power dynamics in the Egyptian mathematics learning context can be drawn from the analysis of preparatory local school students' drawings?

CHAPTER 3

METHODOLOGY

This work presents a contextualization study of students' perceptions of mathematics instruction within the local Egyptian learning culture. More elaborately, the study also sheds light on the external as well as internal pressures that influence a mathematics teacher's decision to prefer adopting a particular teaching approach over another. The work seeks to uncover power dynamics within the mathematics classroom as well as the degree of student participation and student intimidation in the local Egyptian science learning culture. In order to do that, the study took place at a central mixed local school. To study the aforementioned phenomena, the study adopts principles of the DAST research tool that will be presented in more detail on the course of this Chapter. In brief, this work is centered around answering the following question: What insights about classroom power dynamics in the Egyptian mathematics learning context can be drawn from the analysis of preparatory local school students' drawings? This Chapter presents the methodological foundation of the analysis that will follow in the coming Chapter. Figure 3.1 presents the building blocks of this Chapter.

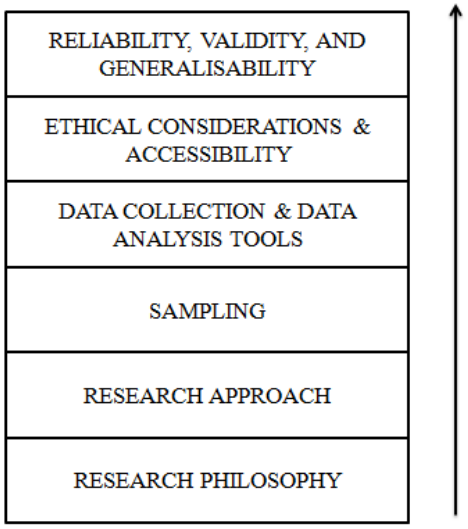

Figure 3.1. Chapter Building Blocks.

As illustrated in Figure 3.1, the Chapter starts by presenting the research philosophy. Following that, the research approach will be discussed as well as the sampling technique. Additionally, also the tools integrated for the data gathering and the means to data analysis will be elaborately discussed. Finally, ethical considerations that relate to accessibility to the data will be also clarified. This will be followed by a discussion about the reliability, generalisability and validity of the analysis. The Chapter ends with a brief summary of the different methodological frameworks that were covered in the Chapter.

3.1. Research Philosophy

Although a wide variety of research paradigms could be adopted to articulate the beliefs that guide a researcher's actions; it is still important to consider the philosophy that lies behind the researcher's knowledge development. This philosophy also mirrors the researcher's view of the very nature of knowledge of a certain subject being studied (Crossan,2003). In the following, this section will be shedding more light on the research philosophy adopted in the knowledge gathering and critical analysis processes that take place in this study.

As already mentioned, this study intends to shed light on the contextual factors that affect student perception of teaching and learning in the field of school mathematics education. The data analysis takes on the form of a qualitative assessment of students' drawings. The drawings are assessed against a framework provided in literature (Miele, 2001). Implications about the classroom pedagogy are made based on the results of that assessment. As part of the drawing assessment, this work adopts a subjective philosophy that differentiates between human drawings and is not merely focused on the quantitative grading of drawing criteria. Instead, the grading scheme considers contexts and surroundings in interpreting common patterns of the students' illustrations. The researcher clearly sees the students, the teachers and the school staff as part-takers and active role players in the school culture's development. In other words, according to the researcher of this work, reality is perceived as being subject to social construction. According to the previous description, the paradigm that forms the foundation of this work is based on the principles of interpretivism (Perry,1981).

Table 3.1 presents the ontological, epistemological and axiological dimensions of this paradigm in more detail. To better comprehend the table, let us recall those three principles. Basically, ontology refers to the nature of reality. Epistemology refers to the scope of knowledge and axiology refers to the ethical considerations behind knowledge (Neuman, 2005).

Table 3.1

The Research Philosophy

Research Philosophy	Research Paradigm: Interpretivism
Ontology (nature of reality)	Multiple realities, subjective, dependant on school culture and social norms
Epistemology (knowledge view)	Several subjective interpretations to same drawing patterns
Axiology (ethical considerations)	Researcher is part of the matter being studied and cannot be separated from it

(adapted from (Easterby-Smith, Thorpe, & Jackson, 2012))

This section has presented the philosophical framework that underpins the upcoming analysis. The next section will present in more detail some further considerations that relate to the research approach.

3.2. Research Approach

Remenyi (1995) classifies research as ranging from a purely scientific perspective, based on calculations and scientific findings to being solely based on observation and accumulated experience. In that case data is gathered via direct and indirect means. The latter framework is also referred to as empirical research, while the first is very often called theoretical research. Literature (e.g. Neuman, 2005) indicates that very minimal research is purely empirical or purely theoretical but that rather most academic work presents an interwoven mesh of the two research perspectives. Both empirical and theoretical research can either be tackled from a qualitative or from a quantitative perspective. Quantitative methods are more common across research that involves sciences whereas qualitative methods, on the other hand, tend to be more popular among humanitarian and social sciences. Yet, nevertheless traces of both approaches can be found across all types of research literature (Yin, 2009). As already mentioned, this work can be classified as qualitative. The analysis is based on a qualitative assessment of student drawings. This assessment is based on an elaboration of pre-designed criteria that can be found in literature (Miele, 2001). The qualitative analysis of the drawings requires an in depth understanding and interpretation of students' perceptions. Often a student's perception may vary in its meaning depending on the context where the drawing exercise is taking place. Instead of being concerned with a quantitative recording of grade scales for each drawing; this work is more oriented towards assessing reasons behind the essence of things. The researcher takes an 'emic' perspective, where s/he is an insider and a part-taker in the culture being studied. It is thus

important for the researcher to note matters that relate to the school's culture as well as the teachers' beliefs and values. The approach is inductive where knowledge about the cultural context is developed over time and accordingly continuous changes are made in the analysis to suit the evolving discoveries that take place throughout the work. This work can therefore be described as also being exploratory. Throughout the data gathering process, the researcher is constantly exploring new knowledge and accumulating this knowledge in order to present a more holistic interpretation to some of the common symptoms in the students' drawings (Fairbrother, 2007). More in depth details in that regard will be presented in the next section.

3.3. Sampling

This work focuses on preparatory school mathematics students studying at local Egyptian schools. The reason for selecting preparatory school students is that the method adopted is mainly building on inferring students' perception of their classroom instruction methodology through the analysis of their drawings. According to the findings of Goodenough (1926), preparatory school age is ideal for this type of study. When students are younger than this, their drawings are often not objective and are often a result of their imagination rather than a description of their current status. At an older age, people are more conscious of the fact that they are being asked to illustrate their perceptions and hence their outcome is not very objective as well. The age of preparatory school is thus the most suitable age for this type of study. On the course of this work, 61 students that attend the same school were asked to draw a sketch and write a narrative in response to a given prompt. The next section will be offering a more elaborative presentation of the teaching and learning context at the school where this research has taken place. For confidentiality purposes, the school name will not be mentioned in this

study. The school will be referred to as School A. Analysis of those drawings will unveil much about teacher mentality and the resulting classroom culture that those students experience.

The sampling section will first start by setting the scene and providing more in depth insight about School A. This will be followed by a more elaborative description of the sample along with the means of their sampling.

3.3.1. Setting the Scene – About the School

School A is a mixed school catering for primary and preparatory year students. There are around 30 students in each classroom. In each classroom student desks are arranged in such a way that there are two students sharing one desk. All desks are arranged to face the blackboard. There are a lot of visual aids hanging along the school corridors. These visual aids include interesting graphical descriptions of mathematics and grammar rules to help the students better comprehend the teaching material. There is a strict level of discipline on the school grounds. Students are all wearing their full uniform, attendance policies are very strict and student behavior and discipline seems to have a very high priority.

School A is also located in a central location in the province of Giza in great proximity of the city center. Over the years, the school has had an excellent reputation in terms of both academia and child behavior modification. Graduates of the school include some of Egypt's most successful spokes- and businessmen. The school fees are not high and hence the school is quite affordable to most of the parents coming from a moderate socio-economic background. Few discussions with the school teachers revealed that there is a great level of satisfaction among the teaching staff. Many of them have been teaching at the same school for over 10 years. One of the

teachers even mentioned that she declined an offer to teach at one of Egypt's most elite schools simply because she loves the learning environment at School A.

3.3.2. Participants

Participants of this study are 61 preparatory school mathematics students aging between 13-15 years. This sample includes a total of 25 female students and 36 male students. All 61 students are of Egyptian nationality and have had minimal experience of living and learning abroad or in a culture that is foreign of the Egyptian collective teaching and learning culture. Though the data was gathered from two classes in the same school, yet it is important to mention that apart from the gender difference, the teacher background, belief system, preparation material and self efficacy is pretty similar for both mathematics teachers. Gathering data from several classrooms within the same school is definitely enriching to the analysis as it provides an additional factor of diversity and credibility.

3.3.3. Sampling Technique

The sampling technique adopted for this study is convenient sampling. It would be of course ideal to test the entire population of students in all schools where teachers are subject to a similar local teaching culture mentality. Nevertheless, given the time limitations of this study, it was only possible to visit one school of that kind. An announcement was made to the students prior to the data gathering process. The announcement informed the students about the researcher and her quest and clearly emphasized that participation in the study is on a voluntary basis, yet the announcement did by no means include any information that might influence the students' performance on the actual drawing task that was yet to follow. Instead, information concerning the drawing task was only provided on the day when data gathering took place. It was also made

very clear, that student contribution will by no means affect their grades and their drawings and comments will remain confidential.

Legal Guardians of the students were provided with the consent form available in Appendix A. Signing this form indicates the formal approval to participating in the study. This was to ensure that all students are freely participating in the study and that there is no bias or pressure neither from the school nor from the researcher. More details about ethical considerations to students' contributions will be available in the coming subsection.

The researcher also received an approval from the Institutional Review Board at the American University in Cairo (Appendix C) in order to insure that there is no harm on the research subjects and that matters of confidentiality will be strictly kept.

3.3.4. Pilot study

As depicted in Figure 3.2, data for this study will take on the form of students' drawings. Literature on both analysis tools (Miele, 2001; Picker & Berry, 2015) indicates that the timeframe allotted for students' drawings in this type of study need not exceed 15 minutes. Nevertheless, to ensure that this is still valid in the context of this study, a preliminary pilot test requested students from the same age group and gender mix as the study's sample to undertake the drawing exercise. Time was calculated and the researcher made sure that a timeframe of 15 minutes is very realistic to allow for freedom for each student's self expression.

3.4. Data Gathering

As already mentioned, the tool that has been chosen for this work is based on the contextual analysis of students' drawings. The data thus takes the form of color coded drawings. Students were given 15 minutes to provide a sketch in response to the following question: "Draw a picture of a mathematics teacher at work in a classroom". In addition to that, students were also asked to

write a short narrative explaining their drawings. The drawing paper was color coded in order to differentiate between male and female students. The data was gathered over two consecutive days. On day one, a total of 29 students participated in the drawing exercise; 17 of them being male and 12 of them being female. The total number of participants on the second day of data gathering was 32 students. These were 19 boys and 13 girls. The data of both classes were kept separate throughout the analysis. On the first day the drawing prompt provided was: "Draw a mathematics teacher at work". After a brief conversation with the school spokesperson the prompt was changed on the second day to include the words "in a classroom". Thus the second group was provided with the following prompt: "Draw a mathematics teacher at work in a classroom". It is important to note that a discussion with the art teacher, who is common among both classes, showed that the students in class 2 generally get higher scores in drawing. This could potentially affect the upcoming analysis. Drawing paper was color coded. Girls used light grey drawing paper while boys used light blue paper. This same color code has been adopted in the presentation of the data analysis that will follow in the next Chapter. Students were given the drawing prompt in Arabic. No further facilitation was offered to the students, neither from the class teacher, nor from the researcher. This was to avoid bias. The students were also asked to write one sentence that explains their drawings. This is in line with the standards set by the DASTT_C analysis tool. It might also be relevant to mention that class 1 have a male mathematics teacher, while class 2 have a female mathematics teacher. A more elaborate comparative evaluation of both students' responses as well as an explanation to the requested change of wording will be discussed in Chapter 4.

The next section presents details of how students' sketches were assessed as part of the data analysis.

3.5. Data Analysis Tools

Picker and Berry (2015) point out that the lecture style of teaching where the teacher is viewed as an authority figure always having the right answers and where problems, ideas and practical applications are held back is a clear demonstration of a product centered classroom methodology. The process of inquiry is held back in favor of teaching the students the means to reach the right answers. Furthermore, Henrion (1997) elaborates on the same point from a student psychology point of view clearly indicating that imagery is a very powerful tool to assess the presence of an unfair power distribution in a classroom. Students that are not familiar with either the product or the process centered instruction might find it difficult to express their perception of the instruction methodology they are being subjected to, if they are being questioned in the form of interview questions. Drawing hence presents a more relaxed medium from which one can deduce much of the students' perception that is often hidden in the subconscious (Farland-Smith, 2003).

Tightly linked with the process-product debate of teaching mathematics is the role of the teacher as a power figure and the power dynamics in a certain classroom. In other words, a process of inquiry would be impossible if the classroom culture and the teacher mentality seeks to cultivate a growing gap between teacher and students. If students feel intimidated or inferior they will not be encouraged to participate.

Hence it can be deduced that, the objective of this study is twofold. First it seeks to assess power struggles in mathematics instruction and their impact on perceiving and learning mathematics. Secondly, directly resulting from the classroom power dynamics; is the perception of the study of mathematics instruction itself. The study tends to further explore the pedagogical debate of product-process centeredness in the instruction of mathematics. Product centeredness results in an authoritarian classroom culture where most power is given to the teacher and to a few selected

good students. Process centeredness instruction, on the other hand ensures that the whole class takes part in the development of knowledge and hence provides a very different inter-student power ratio when compared to the authoritarian hierarchical product centered classroom model (Picker & Berry, 2015).

Based on the principles of the DAST study where students are encouraged to express their impressions about the classroom teaching methodology in the form of drawings, two extensions of the DAST tool were adopted and interlinked to serve the purposes of this study. Details about each of those extensions as well as the type and stage of the double method integration will be presented in this section. First of all, let us present each of the two methods separately. The first method is called the 'Draw a Science Teacher Test Checklist'. This is often referred to as the DASTT_C. The second method is referred to as the DAMT. This is the abbreviation for 'Draw a Mathematician Test'. Brief descriptions of both methods were already provided in the previous Chapters and will be further elaborated on in the coming subsections.

3.5.1. Revisiting the DASTT_C Analysis

In the DASTT_C project, students are given the prompt to draw a science teacher at work. The drawings are assessed to unfold the degree of teacher vs. student centeredness. The assessment of the drawings is mostly concentrated on three factors. These include firstly the depiction of the teacher, secondly that of the student and thirdly that of the classroom environment. Each of those three elements can then be further divided to include more details. Table 3.2 shows a clear elaboration of that analysis**.**

Table 3.2

DASTT_C Grading Criteria

Element	Criteria	Feature
Teacher	Activity	Demonstrating Experiment
		Lecturing
		Visual Aid
	Position	Centrally Located
		Standing
Student	Activity	Watching & Listening
		Responding to Questions
	Position	Seated
Environment	Student Desk Arrangement	
	Location of Teacher Desk	
	Symbols of Teaching	
	Lack of Group Work Signs	

(adapted from (Thomas, Pedersen, & Finson, 2001))

As already mentioned, the drawings are rated to check for the occurrence of the above described grading criteria. If a certain symptom is present, the drawing gets one extra mark. In total, the maximum score that a drawing can get is 13 points. That is if all of the criteria are present in the student's drawing. A decoding matrix (Table 3.2) has been set in place against which the researcher can use to better interpret the drawing results. This matrix will be presented in the upcoming table.

Table 3.3

DASTT_C Interpretation of Results

Exploratory Teaching Style (0 - 4)	Conceptual Teaching Style (5-9)	Explicit Teaching Style (10-13)
Teacher believes students are capable of managing their own learning	Teacher believes students need themed, conceptual learning experiences	Teacher believes students lack knowledge and need assistance in learning
Curriculum is open to student interests	Content is explanatory organised around key concepts	The curriculum is focused on specific outcomes
Teacher leades and guides student activities and investigations	Teacher organises the connections of content and processes of science	Teacher is knowledge conduit (telling is teaching)
Teacher focuses on student questions as an instructional goal	Teacher centered lessons include hands on activities, group work and discussion of ideas	Teacher initiates activities. Student input is acknowledged but not expected
Alternative assessment measures student learning and knowledge	Tests check for understanding of important concepts	Tests focus on science content knowledge

(Thomas et al., 2001)

As indicated in Table 3.3, each of the scores denotes a certain teaching style. Literature (Thomas et al., 2001) distinguishes between three teaching styles, namely the exploratory, the conceptual and the explicit teaching style. If placed on a continuum, the exploratory teaching style would most highly be representative of the student centered approach where the teacher treats the student as a co-author of knowledge and where student ideas are highly appreciated. At the other end of the continuum, the explicit teaching style denotes the pedagogy of teacher and workbook oriented teaching. Students are perceived as passive receptors of knowledge. Their contribution is neither expected nor seen as necessary. It is also important to mention that neither of the teaching styles is right or wrong as such. Instead, this study intends to shed light on the culturally

accepted learning and teaching model in Egyptian local schools. The upcoming teacher self efficacy and school contextual analysis will further elaborate on that matter. This subsection presented the objective of the DASTT_C Analysis Method along with its grading scheme and data encoding matrix. The following subsection will focus on presenting the DAMT Analysis Methodology in more detail.

3.5.2. Revisiting the DAMT Analysis

The DAMT Analysis is somewhat similar to the DASTT_C analysis in terms of its set-up. Similarly, this analysis is also based on a 15 minute student drawing prompt and a short narrative in response to a given question. In this analysis the student drawing prompt is a bit different though. In the DAMT analysis, students were asked to depict their perceptions of mathematicians. In addition to that, students are requested to respond to the following question in written form: "If you have a leaky tap or faucet, you need to hire a plumber; if you break your leg you need the services of a doctor. List below all the reasons you can think of for which someone would need to hire a mathematician." (Picker & Berry, 2015,p.67).

Hence, similar to the DASTT_C, this tool too is twofold. It includes a narrative section and a drawing section. For the sake of this work, the focus will only be on the drawing part. Analyses of responses to a written prompt were omitted in this study due to time constraints and because of the language barrier. Students would probably respond to the prompt in Arabic and this would add to the complexity of the decoding analysis. Also similar to the DASTT_C analysis, students were encouraged to write a small narrative that better describes the drawing. The drawings are graded according to a set of criteria that will be presented in Table 3.4.

Table 3.4

DAMT Analysis

Feature in Drawing	Interpretation
1- Mathematics as coercion	
violence and presence of threatning tools	use of intimidation, violence and punishment to make students learn
threatning position of teacher	
unrealistic scale of drawing (teacher in big size while students are in small size	
Teacher seemingly standing on a stage	
2- The Mathematician who can't teach	
Teacher confusing simple arithmatic operations	Teacher seems to have no control over the classroom and no idea about the subject matter
Teacher is unsocial and unable to explain	
3- The Overwrought mathematician	
Teacher looking wild, strange clothing, facial hair	Lack of sense of balance in teaching - Teacher is seemingly only targeting one group
Traces of stress in teacher's facial expressions	
4- The Foolish Mathematician	
lack of common sense	Teacher is unable to cater for the students needs and is seemingly working at a different level than the one desired by students.
lack of basic computational abilities	
old fashioned clothes or mismatched outfit	
Silly hair style	

5- The Einstein Effect	
Image of Einstein	Mathematics is seemingly only for a chosen few
Symbols used by Einstein such as E=mc	
general stereotypical imagery	

6- The Mathematician with special powers	
Harry Potter or Superman symbols or the like	Similar to the previous section, also this drawing would indicate that mathematics is not for everybody
any kind of wizardy depictions	

7- Disparagment of mathematics	
Too clever pupils	Again here the interpretation is similar to the previous two categories
Almost unnatural setting	
Pupils are not very social	

(adopted from (Picker & Berry, 2015))

As illustrated in Table 3.4, the assessment criteria of the drawings are somewhat different than those of the previous tool. In this tool, the researcher is encouraged to look for traces of one of the seven features. These features have been summarized in Table 3.4. For each feature, literature (Picker & Berry,2015) provides some guidelines to indicate how to better trace this feature. The Table also shows the interpretation of why these features are important and what they represent.

Picker & Berry (2015) argue that the general lack of perception of mathematics as a process, results in the depictions that show that extraordinary powers are needed to solve mathematical problems. The reason for that is that students feel so intimidated that they cannot reach the correct end product that they decide to rest in the fact that mathematics is simply not for everyone and is rather a subject for a selected few. Had these same students been exposed to an instruction method that focused on the process, then maybe they would have been able to at least

reach half way the correct product and they wouldn't be perceiving mathematics to be only for a chosen few with special powers. Based on this, the authors (Picker & Berry, 2015) classify subcategories 5,6 and 7 (Table 3.4) as indicators for the presence of a product centered pedagogy.

Moreover, Picker & Berry (2015) argue that the lack of balance in a classroom culture where the teacher is taking an authoritarian position and the students are asked to blindly follow, can result in two forms of manifestations in drawings. Either the drawings would indicate threatening, violence or the general sense of intimidation (subsection 1 –Table 3.4). The other option is that students tend to redress to ridicule their teacher (by depicting him or her as foolish or incapable of teaching – subsections 2,4 –Table 3.4) in their drawing as a means to counterbalance the unfair power dynamics they are experiencing in class. Based on their own sense of intimidation they project their own sense of inferiority by illustrating their teachers as foolish or incapable of teaching (subsections 2,4-Table 3.4).

3.5.3. Double Method Integration

The double method integration chosen for this work involves a two stage sequential integration of two equal status qualitative methods; i.e. the results of the first analysis will act as a guideline for the second analysis. The second analysis will either confirm or contradict the findings of the first analysis. Interpretations to the findings will be sought in the principles of the social cognitive theory and the cultural contextualization. Both of these principles were tackled in more detail in the previous Chapter and will further be elaborated on in the next Chapter. Hence the sequential analysis will follow the pattern depicted in Figure 3.2. Also as previously mentioned, parts of the second tool were omitted in order to serve the specific purpose of the study. More details to that will follow in this section.

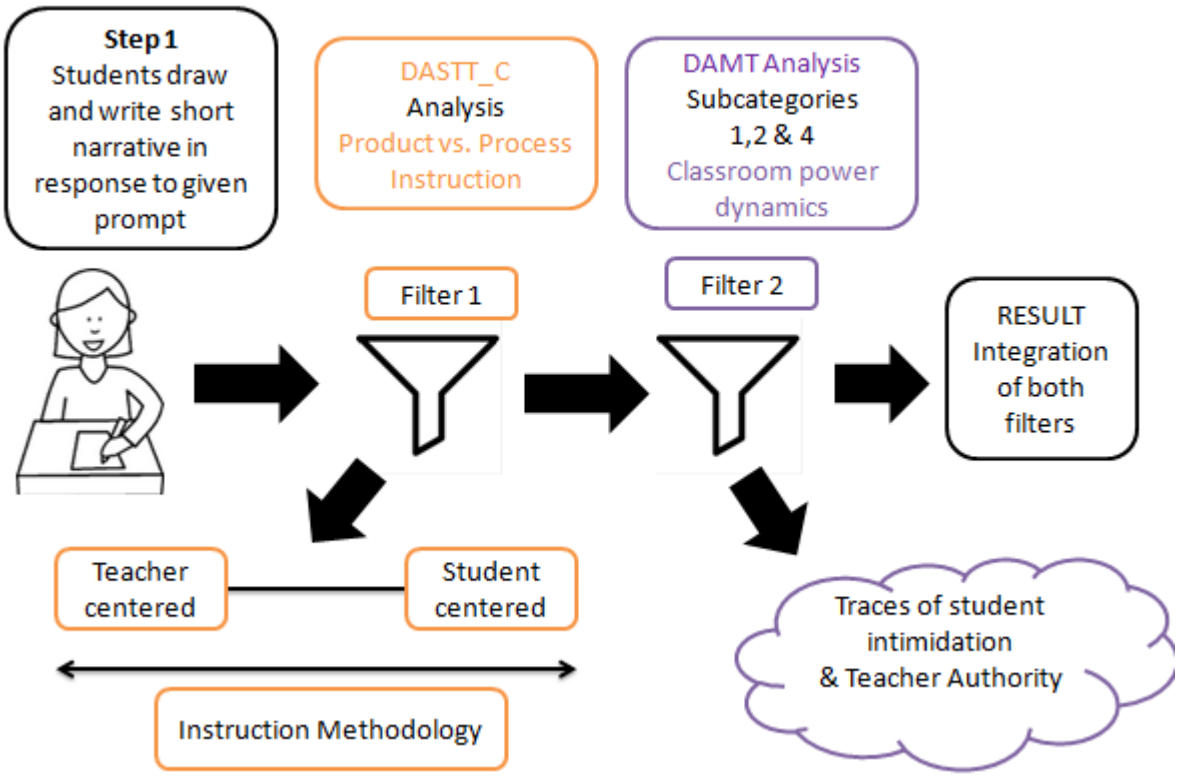

Figure 3.2. Double Method Integration[1]

As illustrated in Figure 3.2, students will be given a drawing prompt and will be requested to respond to the drawing prompt in 15 minutes. This timeframe has been advised by literature (Miele, 2001; Picker & Berry, 2015) and was further confirmed in the pilot study (subsection 3.4.2.4) to be suitable for the Egyptian teaching and learning context. It is also suitable for both

[1] Source of clipart depicting female student drawing: https://www.google.com.eg/search?q=classroom+clipart&espv=2&biw=1366&bih=643&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoAWoVChMIyLO9u8ndyAIVBbQaCh0O8wQg#tbm=isch&q=student+drawing+black+and+white&imgrc=WgCbnytUX6i0YM%3A

Source of clipart showing filter: https://www.google.com.eg/search?q=classroom+clipart&espv=2&biw=1366&bih=643&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoAWoVChMIyLO9u8ndyAIVBbQaCh0O8wQg#tbm=isch&tbs=rimg%3ACTRPQ93yjyh-IjhsZX9vA6BErwkkyXQLBXFIszeR_1Kk6B53MGRrnmaWkSeasMsO8E8yzwFHue88V_1QOlXlunIMGeVSoSCWxlf28DoESvEScs3SBwE3KVKhIJCSTJdAsFcUgRRsGzNmGzed8qEgmzN5H8qToHnRHwRs3i6XFMwSoSCcwZGueZpaRJEZPicv2CXj7WKhIJ5qwyw7wTzLMRbk8uIkRT3GUqEgnAUe57zxX9AxEDYXJkftDWpSoSCaVeW6cgwZ5VEVCnt-9B-YLx&q=filter%20black%20and%20white&imgrc=fIVxKd30z3seIM%3A

fast and slow drawers. Students were also asked to write a small narrative that describes their drawing prompt. This narrative will simply act as a guide for the assessment of the drawings in case a certain sketch is unclear to the grader. The prompt chosen takes into consideration traces of drawing prompts in both methods. This is also illustrated in Figure 3.3.

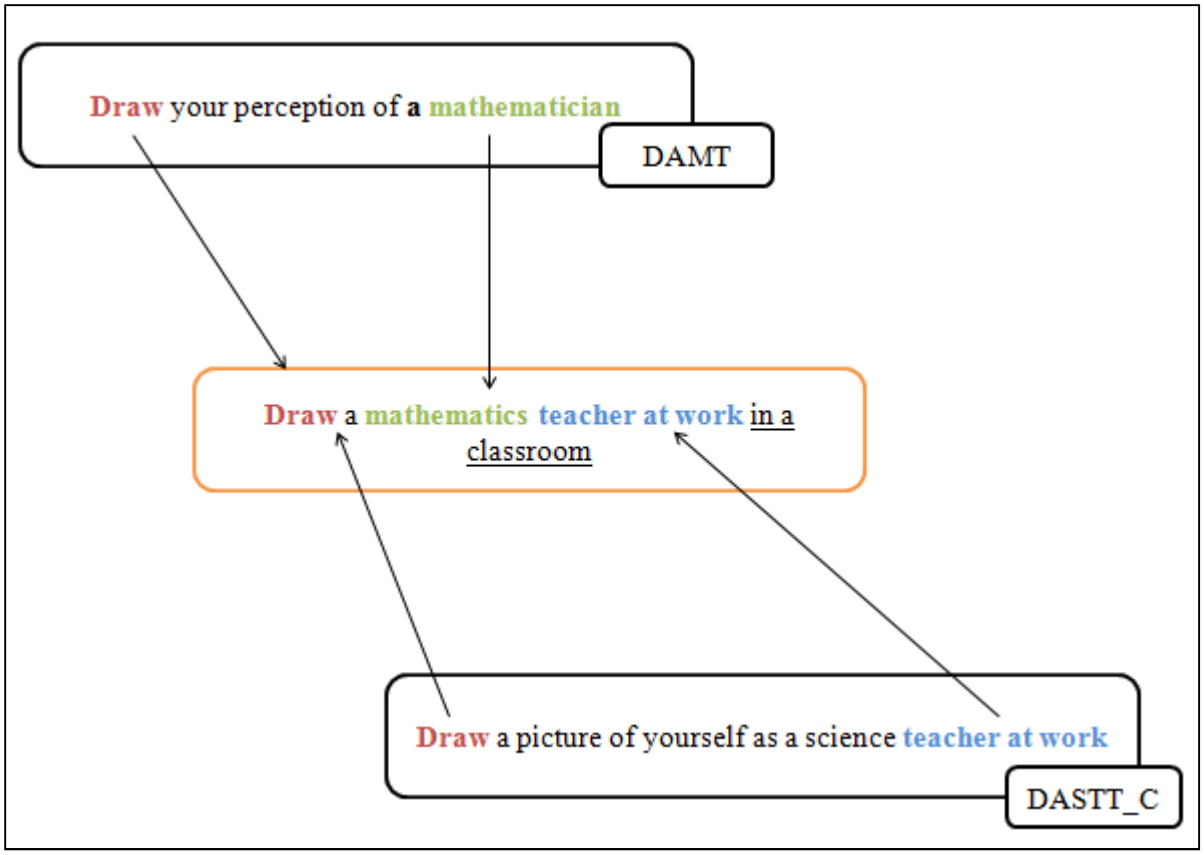

Figure 3.3. Formulation of Drawing Prompt.

As illustrated in Figure 3.3, the drawing prompt has its routes in the integration of both methods together. On the one hand, the request to draw a teacher is based on the principles of drawing a science teacher at work from the DASTT_C Analysis. The particular request to draw a mathematics teacher however has traces in the DAMT Analysis. Thus the first tool acts as a guide for teacher pedagogy assessment while the second is more focused on the perception of

mathematics as a subject and mathematicians as knowledge providers as subject experts. As already mentioned, the words 'in a classroom' were added to the prompt only on the second day of the data analysis. The addition of those words will be further elaborated on in the coming Chapter.

Students' drawings will be assessed firstly according to the criteria in Table 3.2 in order to assess the degree of teacher vs. student centeredness in the mathematics classroom. Following this assessment, the drawings will go through a second filter that searches for extra indicators of traces for an authoritarian teacher or a pedagogy that is product oriented. This second filter will mostly focus on assessing the drawings against the criteria of the DAMT study. In order to ease this second analysis, the tracing of these criteria has been put in the form of 'yes and no' questions. These are presented in Table 3.5.

Table 3.5

DAMT Drawing Assessment Criteria

		Class #			
		# female		# male	
		yes	no	yes	no
1	Can you find signs of violence or the presence of violent tools in the image ?				
2	Is the position of the teacher threatning to the student ?				
3	Is the scale of drawing proportional (i.e. teacher size vs. student size)				
4	Is the teacher seemingly standing on a stage ?				
5	Is the image being ironic of the teacher ?				
6	Does the figure depict the teacher to be dressed in old fashioned clothes ?				
7	Can you find any form of stereotypical imagery ?				
8	Are there any wizardy or cartoon symbols of teachers with special powers ?				
9	Is there an unbalanced match between the students?				

Table 3.5 presents a set of 'yes and no' questions. The number of female and male responses in each class will need to be traced in each of the columns. According to literature (Picker &

Berry,2015), the results will be useful to inform about the power dynamics in the classroom. The questions in Table 3.5 are by no means a summative collection of the entire DAMT Analysis prompt. Instead those questions were designed with the help of the framework provided in Table 3.4, as they are most descriptive of a power struggle assessment in the researcher's point of view.

In summary, the method integration will take on a sequential form, where results of the DASTT_C Analysis will act as guidelines to the DAMT Analysis. The student drawing prompt has been developed as an overlap between the drawing prompts used for both DAST extension methods. Analysis criteria of the drawing part of both tools will be taken into consideration. To ease the second analysis, a set of questions (Table 3.5) that are founded in literature about DAMT (Picker & Berry, 2015) have been developed. Also, as already mentioned the drawing papers will be color coded in order to ease the comparative analysis that will follow the data gathering phase. After the drawings go through the two filters (figure 3.2), statistics will be developed in order to compare between the drawings of students.

3.6. Ethical Considerations and Accessibility

As the participants of this study are minors, it was necessary that all precautions are put in place to assure that students are not by any means disadvantaged. After seeking approval from the Institutional Review Board (view Appendix B) a preliminary meeting took place at the school where the school representative, the principal and the head of the mathematics department were informed about the study. Following that, approval forms (view Appendix A) were sent out to the students' legal guardians informing them about the study's target, timeframe and importance. Legal guardians were only informed second hand through the school and hence out of 61 requests, only 19 approvals came back. A conversation with the school representative revealed however that the parents were not very familiar with research methods and were thus worried

that participation in this drawing prompt would affect the student's academic progress. After further clarification by the researcher herself, it became clear to the students that participation would in no way affect the students' grades. Afterwards verbal consent from the participants along with a second confirmation from the school both confirmed that the parents are happy to have their children participate in the study. It was then possible to have all 61 students on board.

3.7. Reliability, Validity and Generalisability

According to literature (Medina-jerez, Middleton, & Orihuela-rabaza, 2011), in order to insure reliability of the analysis, two independent graders would have been necessary to assess the images. To insure that the results of both graders are both valid, it would have been also important to make sure that both graders have received the same training to the developed drawing assessment tool. To avoid bias, the researcher is expected to be distanced from the dual drawing grading process in order to give space for the individual graders to assess the drawings. Though this would be true if the study would adopt a quantitative approach where the results are all based on the quantitative comparative assessment of both graders, the qualitative nature of the study requires however different considerations. Being a qualitative study, it was important that the researcher herself grades the drawings. Having been in the school four times and having had some conversations with some of the teaching staff, it was important that some of the classroom topology and teacher background contextual factors be taken into consideration as part of the drawing analysis. Moreover, this study is simply representing the relationship between teacher centered – student centered instruction and classroom power dynamics in the very particular context of one local school in Egypt. As a contextual study, it is not intended for the results to be generalized across different contexts.

3.8. Summary

This Chapter has covered philosophical viewpoints that this study is based on. This is along with the manifestation of those philosophies into the particular research paradigm that is of relevance for this study. Also, on the course of the Chapter, the research approach was elaborately explained along with the means to sampling. Also, details that relate to the data gathering and data analysis were presented. The tool chosen for the analysis was clearly explained along with the double tool integration method. The Chapter ended with a discussion on ethical considerations and matters that relate to generalisability and validity of the study. Briefly, the findings of this Chapter can be summarized in Table 3.6:

Table 3.6

Chapter Summary

Research Paradigm	Interpretivism
Research Approach	Inductive
Research Strategy	Case Study
Choice of Method	Integrated Sequential Qualitative Dual Monomethod
Data Analysis Techniques	Sequential Integration DASTT_C and DAMT Analysis

CHAPTER 4

DATA ANALYSIS & FINDINGS

As elaborately discussed in the previous Chapters, this work constitutes a contextualization study of students' perceptions of mathematics within the local Egyptian learning culture. More specifically, the study aims to answer the following question: What insights about classroom power dynamics in the Egyptian mathematics learning context can be drawn from the analysis of preparatory local school students' drawings? To answer this question, two well established research tools have been adopted, namely the DASTT_C tool and the DAMT tool. The first tool is primarily designed to assess teacher vs. student centeredness generally in science classrooms while the second tool is more oriented towards measuring the teacher's authority particularly in a mathematics classroom. Both tools base their methodological framework on a 15 minute student drawing prompt. More elaboration about the exact analysis methodology of each tool is also available in Chapter 2. Figure 4.1 again summarizes the preliminary overall process of data gathering and analysis that was discussed in Chapter 3.

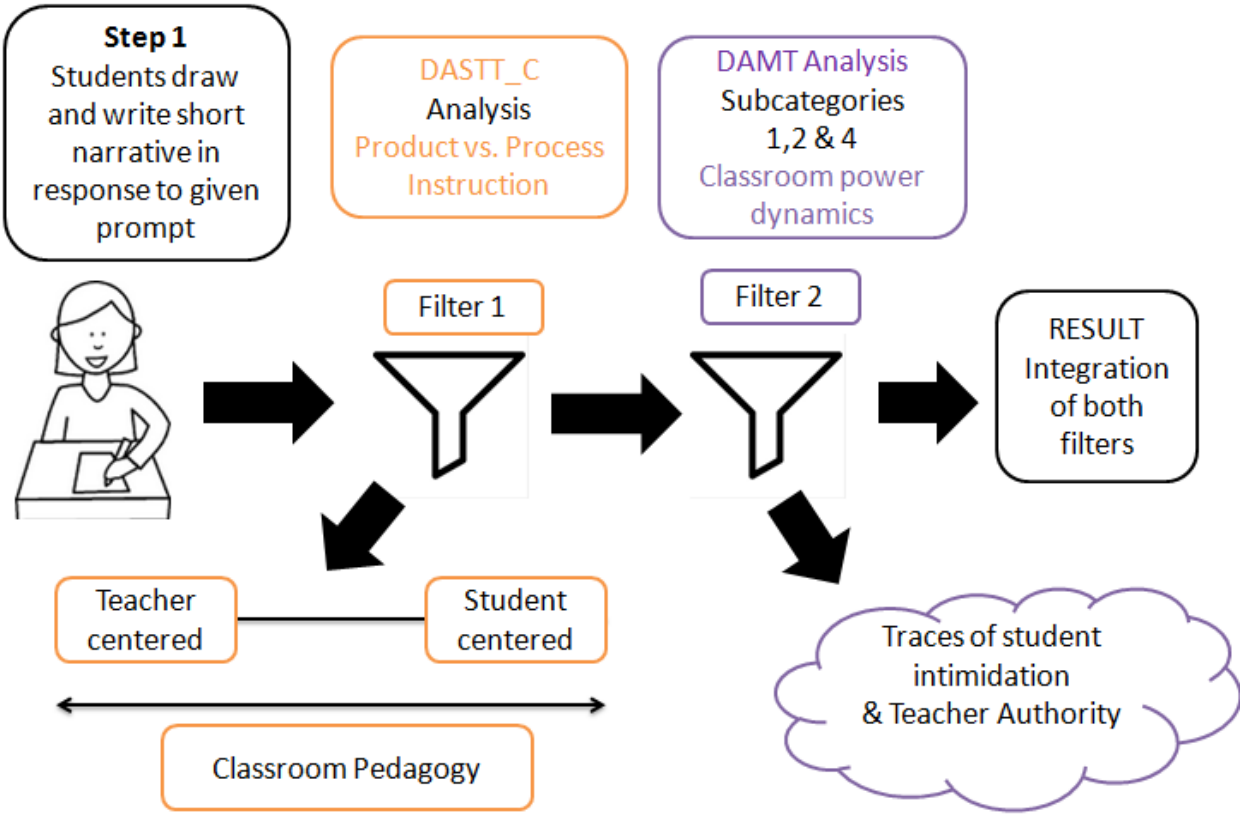

Figure 4.1. Data Gathering and Analysis Methodology.[1]

As clearly depicted in Figure 4.1, the process of data gathering starts with a 15 minute drawing prompt that male and female preparatory school students have to respond to. The students were asked to 'draw a mathematics teacher at work in classroom'. Following the data gathering, the

[1] Clipart images in the figure were retrieved from:
Student Drawing :
https://www.google.com.eg/search?q=classroom+clipart&espv=2&biw=1366&bih=643&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoAWoVChMIyLO9u8ndyAIVBbQaCh0O8wQg#tbm=isch&q=student+drawing+black+and+white&imgrc=WgCbnytUX6i0YM%3A
Filter:
https://www.google.com.eg/search?q=classroom+clipart&espv=2&biw=1366&bih=643&source=lnms&tbm=isch&sa=X&ved=0CAYQ_AUoAWoVChMIyLO9u8ndyAIVBbQaCh0O8wQg#tbm=isch&tbs=rimg%3ACTRPQ93yjyh-IjhsZX9vA6BErwkkyXQLBXFIszeR_1Kk6B53MGRrnmaWkSeasMsO8E8yzwFHue88V_1QOlXlunIMGeVSoSCWxlf28DoESvEScs3SBwE3KVKhIJCSTJdAsFcUgRRsGzNmGzed8qEgmzN5H8qToHnRHwRs3i6XFMwSoSCcwZGueZpaRJEZPicv2CXj7WKhIJ5qwyw7wTzLMRbk8uIkRT3GUqEgnAUe57zxX9AxEDYXJkftDWpSoSCaVeW6cgwZ5VEVCnt-9B-YLx&q=filter%20black%20and%20white&imgrc=fIVxKd30z3seIM%3A

data analysis goes through a process of two consecutive filtrations. In the first step, the DASTT_C tool is used to uncover the pedagogical orientation of the teacher and to place this on the student-teacher centered continuum. Following that step, the second filter adopts some features of the DAMT tool. This second filter mostly targets the analysis of power dynamics in the classroom. Results of both filters will be finally integrated to yield the final conclusion.

Figure 4.2 illustrates in more detail the outline of this Chapter:

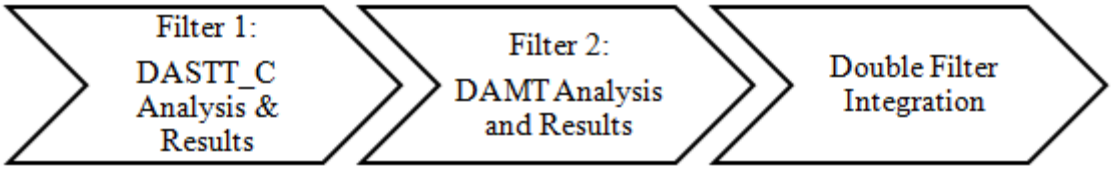

Figure 4.2. Structure of Chapter 4.

As illustrated in Figure 4.2, this Chapter is divided into three main parts. These will be presented in the coming sections.

4.1. The DASTT_C Analysis

Briefly the DASTT_C Analysis is a tool to test the degree of teacher vs. student centeredness learning atmosphere in science classrooms. The tool basically is based on the analysis of students' drawings in response to the following question: "Draw a science teacher". A checklist has been put in place to facilitate the analysis. The checklist basically includes a list of 13 items that the researcher needs to spot in the drawing. If the item is present in the drawing then the researcher grades this by placing a '1'. Else, the researcher grades this part with a '0'. Adding up the collective grades for the drawings reveals the degree to which instruction is teacher vs. student centered (Miele, 2001). A more elaborate explanation of the DASTT_C method is also

available in Chapter 3. As previously mentioned, the data gathering took place over two stages (class1 and class2). Each class caters for a fairly well distributed mix of male and female students. Relevant to the analysis is also the fact that in the classroom topology students are seated in such a way, that there are two students at each desk. Tables 4.1 and 4.2 present the results of the DASTT_C Analysis for class1 and class2 respectively.

Table 4.1

DASTT_C Analysis Class 1 (12 female & 17 male)

DASTT_C Criteria			Girls (Class 1)												Boys (Class 1)																
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Teacher	Activity	Demonstrating Experiment	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Lecturing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0*	1	1	1	1	0*	1	1	1	1	1	1	1	0*	1
		Visual Aid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Position	Centrally located	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	1	1	0	0	0	1	1	1
		Standing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Student	Activity	Watching & Listening	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1	0	1	n/a	n/a*	1	n/a	n/a	1	1	1	n/a*	n/a	1
		Responding to questions	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	0	0	n/a	n/a*	0	n/a	n/a	1	0	0	n/a*	n/a	1
	Position	Seated	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1	1	1	n/a	n/a*	1	n/a	n/a	0	1	1	n/a*	n/a	0
Environment		Student Desk Arrangement	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1*	1*	1*	1*	1*	1	n/a	n/a	1*	1	1*	1*	n/a	1
		Location of Teacher Desk	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	0*	0*	0	0*	0*	n/a	n/a	0*	0*	0*	0*	0	0*
		Presence of Maths Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0*	0	0	0	0	0	0	0	0	0	0	1	0
		Symbols of Teaching	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
		Lack of group work signs	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1*	1*	1*	1*	0	1	1	1*	1	1*	1*	1	1
		Total Score	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	6	6	8	6	5	6	5	5	7	6	7	6	5	8

Table 4.2

DASTT_C Analysis of Class 2 (12 female & 19 male)

DASTT_C Criteria			Girls (Class 2)													Boys (Class 2)																		
			1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Teacher	Activity	Demonstrating Experiment	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Lecturing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1*	0*	0	0*	1	1	1	1	1	1	1	1	1
		Visual Aid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Position	Centrally located	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0*	0	0*	1	1	1	1	1	1	1	1	1
		Standing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
Student	Activity	Watching & Listening	1	n/a	n/a	n/a	n/a	n/a	1	n/a	n/a	n/a	n/a	1	n/a	n/a	n/a	n/a	1	n/a	n/a	1	0*	0	0	1	0	0*	n/a	n/a	n/a	n/a	n/a	n/a
		Responding to questions	1	n/a	n/a	n/a	n/a	n/a	0	n/a	n/a	n/a	n/a	0	n/a	n/a	n/a	n/a	1	n/a	n/a	1	0	1	1	0	1	0*	n/a	n/a	n/a	n/a	n/a	n/a
	Position	Seated	1	n/a	n/a	n/a	n/a	n/a	1	n/a	n/a	n/a	n/a	1	n/a	n/a	n/a	n/a	1	n/a	n/a	1	0	1	0	1	1	0*	n/a	n/a	n/a	n/a	n/a	n/a
Environment		Student Desk Arrangement	1*	n/a	n/a	1*	1*	n/a	1	n/a	n/a	n/a	n/a	1	n/a	n/a	n/a	n/a	1	n/a	n/a	1*	0	1*	0	1*	1*	0	n/a	n/a	n/a	n/a	n/a	n/a
		Location of Teacher Desk	0*	n/a	n/a	n/a	n/a*	n/a	0*	n/a	n/a	1	n/a	1	1	n/a	n/a	n/a	1	n/a	n/a	0*	0	1	0	0*	0*	1	n/a	n/a	n/a	n/a	n/a	n/a
		Presence of Maths Equipment	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
		Symbols of Teaching	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Lack of symbols of group work	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Total Score	10	5	5	6	6	5	9	5	5	7	5	9	6	5	5	5	10	5	5	9	3	8	3	8	8	7	5	5	5	5	5	5

Tables 4.1 and 4.2 present the results of the DASTT_C Analysis for classes 1 and 2. As presented in the table, the grading criteria are all placed at the left side of each table. Results for male and female students are coded with the same color scheme used to code the drawings during the data gathering phase. Each drawing is assessed against the criteria and either graded with a '1' or with a '0'. The grading is based on the presence or absence of the specific criterion being checked.

Occasionally, some features are coded with 'n/a'. In this case the feature is not present in the drawing and hence it is impossible to trace that element in the drawing. For instance, many of the students simply depicted a teacher standing at the blackboard. They did not draw the students. Hence it was impossible to grade the students' behavior according to the criteria in the tables. Since the framework of this work is based on qualitative measures, it is important to note that features that were labeled with 'n/a' were not discarded but rather received further attention with regards to their possible implications. This also means that the interpretation of the final score will have to be iterated. Since 'n/a' features were not discarded, the overall scores of the drawings cannot be quantitatively compared. The interpretation of the final score is rather based on a qualitative analysis measures.

Also it is worth noting, that sometimes some scores include an '*' sign. In that case there were interesting additional features that were separately reported in a different set of tables (Table 4.3 and Table 4.4).

Overall, in both classes the majority of students have depicted a male teacher explaining basic arithmetic functions at the blackboard. In most drawings the teacher is smiling. In very few drawings there are students illustrated. The teacher desk is almost never present in most

drawings. Even in class2, where the mathematics teacher is a female, most students drew a male teacher. None of the figures shows traces of group work. Contrary to the class desk topology, most drawings show that only one student is seated at each desk which again could be a reflection of the singularity of student participation in the classroom. Almost not one drawing shows the presence of visual aids in the classroom. This could however be due to the fact that in the school most visual aids are hanging in the hallways rather than the classroom. It is also important to note that most drawings present a similar features of a mathematics teacher in a classroom which adds to the credibility of the exercise. Seemingly most students have a similar perception of their mathematics instruction methodology. Common features in the drawings could be traced to the proximity of seating, yet across different classes same common features were still repeatedly presented across students' drawings.

The first element of the DASTT_C analysis checklist, namely the teacher performing an experiment was removed, as this was perceived to be more suitable for a science classroom. There is generally minimal space for performing an experiment at school level mathematics instruction.

On the first day of data gathering, it was obvious that most students only depicted the mathematics teacher standing at the board and explaining some mathematical phenomena to the students. Very few images show traces of student participation. A discussion with the school spokesperson suggested that this could be attributed to a lack of precision in the drawing prompt, as the drawing prompt does not clearly state that the teacher is located in a classroom. The prompt was thus adapted on the next day to include the words 'in the classroom' but still most students' images did not show traces of student participation.

Table 4.3

Additional Features for Class 1*

Drawing Number	Student Gender	Additional Features*
3	male	Teacher is depicted totally facing the board and hence completely giving his back to the students
4		Student depicted female students being clearly split in terms of student seating
	male	Student did not depict teacher desk although student desks are present
5		Student depicted one student sitting separately at each desk though the actual class topology is different
		Student depicted the teacher teaching a religion class and wrote in his explanation that the students were not paying attention
		This is not in line with the drawing prompt given and clearly explained to the students
	male	Student did not depict teacher desk although student desks are present
6		Student did not depict teacher desk although student desks are present
	male	Student depicted one student sitting separately at each desk though the actual class topology is different
7	male	Student desks are depicted with no students sitting at the desks
8		Teacher is depicted totally facing the board and hence completely giving his back to the students
		Student desks are depicted with no students sitting at the desks
	male	Student did not depict teacher desk although student desks are present
9		Some students in the drawing are smiling while others are frowning
	male	Student did not depict teacher desk although student desks are present
12		Student depicted sitting upside down
		Student did not depict teacher desk although student desks are present
	male	Student depicted one student sitting separately at each desk though the actual class topology is different
13	male`	Student did not depict teacher desk although student desks are present
14		Student did not depict teacher desk although student desks are present
	male	Student depicted one student sitting separately at each desk though the actual class topology is different
15		Student did not depict teacher desk although student desks are present
		Student desks are depicted with no students sitting at the desks
	male	Student depicted the teacher instructing the students to respond to his questions (student integration)
16	male	Teacher is depicted totally facing the board and hence completely giving his back to the students
17	male	Student did not depict teacher desk although student desks are present
	Note:	Repeating Patterns are color coded

Table 4.4

Additional Features for Class2

Drawing Number	Student Gender	Additional Features*
		Student did not depict teacher desk although student desks are present
1	female	Student depicted one student sitting separately at each desk though the actual class topology is different
4		Student desks are depicted with no students sitting at the desks
	female	Student did not depict teacher desk although student desks are present
		Student desks are depicted with no students sitting at the desks
5	female	Student did not depict teacher desk although student desks are present
7	female	Student did not depict teacher desk although student desks are present
		The student depicted a teacher explaining to the students in the presence of another lead teacher
		Student did not depict teacher desk although student desks are present
7	male	Student depicted one student sitting separately at each desk though the actual class topology is different
8	male	Student depicted a teacher encouraging a student to present something to his peers
9	male	Student depicted one student sitting separately at each desk though the actual class topology is different
10	male	Student depicted a teacher encouraging a student to present something to his peers
		Student depicted one student sitting separately at each desk though the actual class topology is different
11	male	Student did not depict teacher desk although student desks are present
		Student depicted one student sitting separately at each desk though the actual class topology is different
12	male	Student did not depict teacher desk although student desks are present
13	male	Student depicted an image of the teacher explaining to no audience while the students are being punished
		Student depicted one student sitting separately at each desk though the actual class topology is different
		Student did not depict teacher desk although student desks are present
		Student desks are depicted with no students sitting at the desks
15	male	Student depicted the teacher instructing the students to respond to his questions (student integration)
16	male	Teacher is depicted totally facing the board and hence completely giving his back to the students
17	male	Student did not depict teacher desk although student desks are present
	Note	Repeating Patterns are color coded

Table 4.3 and Table 4.4 both depict elaborations to features presented in the DASTT_C Analysis Results (Tables 4.1 and 4.2). Across different genders and different classrooms, some common features in the drawings just kept repeating. This created the need to give those features more attention. To do that, let us add an additional filter to the analysis filtration methodology depicted in Figure 4.1. This additional filter documents and traces the degree of re-occurrence of some repeating features. For the sake of simplicity, the common factors in Table 4.3 and 4.4 were grouped together into five extra filtration features. Those subcategories are the following:

1) *Presence of students in the drawing***:** As already mentioned several figures only show the teacher explaining; ignoring completely the audience to which classroom instruction is offered. This could possibly indicate the lack of differentiation in terms of instruction methodology and the students' perception of not being part-takers of the learning process. A discussion with the school spokesperson offered another possible explanation, namely that the prompt given to the students on the first day did not clearly indicate that they need to draw a mathematics teacher in a classroom. The prompt simply requested the students to draw a mathematics teacher. In order to avoid confusion, the next day's prompt clearly requested the students to draw a mathematics teacher in a classroom. Yet the results still yielded similar responses with almost the same ratio of no occurrence of the audience in the drawings.
2) *Presence of teacher desk*: Interestingly, very few students depicted the teacher desk. Even when student desks were drawn, the teacher desk was not present in the drawing. This could imply that the teacher is mostly performing his job while standing at the class front, which according to the DASTT_C is an indicator of teacher centered instruction.

3) *Gender of teacher*: Among both classrooms most figures presented the teacher to be a male figure. Even in that class where the actual mathematics teacher is a female did the students draw a male teacher. This is in line with the findings in literature (Farland-Smith, 2003; Mansour, EL-Deghaidy, Alshamrani, & Aldahmash, 2014; Miele, 2001) about the general perception of mathematics to be a male dominated field.

4) *Basic Arithmetic Operations on Blackboard*: It is interesting to consider the ratio of students depicting the general stereotypical association of mathematics (Goldstein, Schappacher & Schwermer,2007) as being simply about arithmetic operations.

5) *Teacher Smiling:* Since this study addresses the degree of teacher authority and student intimidation from the subject of mathematics, it is important to clearly mention this trait that is almost common in all drawings. This will also be very relevant to the DAMT Analsyis to follow.

In brief, the aforementioned five factors were very common among most students' drawings. It was hence important that they receive extra attention. In accordance with that, the initial filtration procedure (Figure 4.1) of the analysis can be re-adjusted to include this elaboration (Figure 4.3).

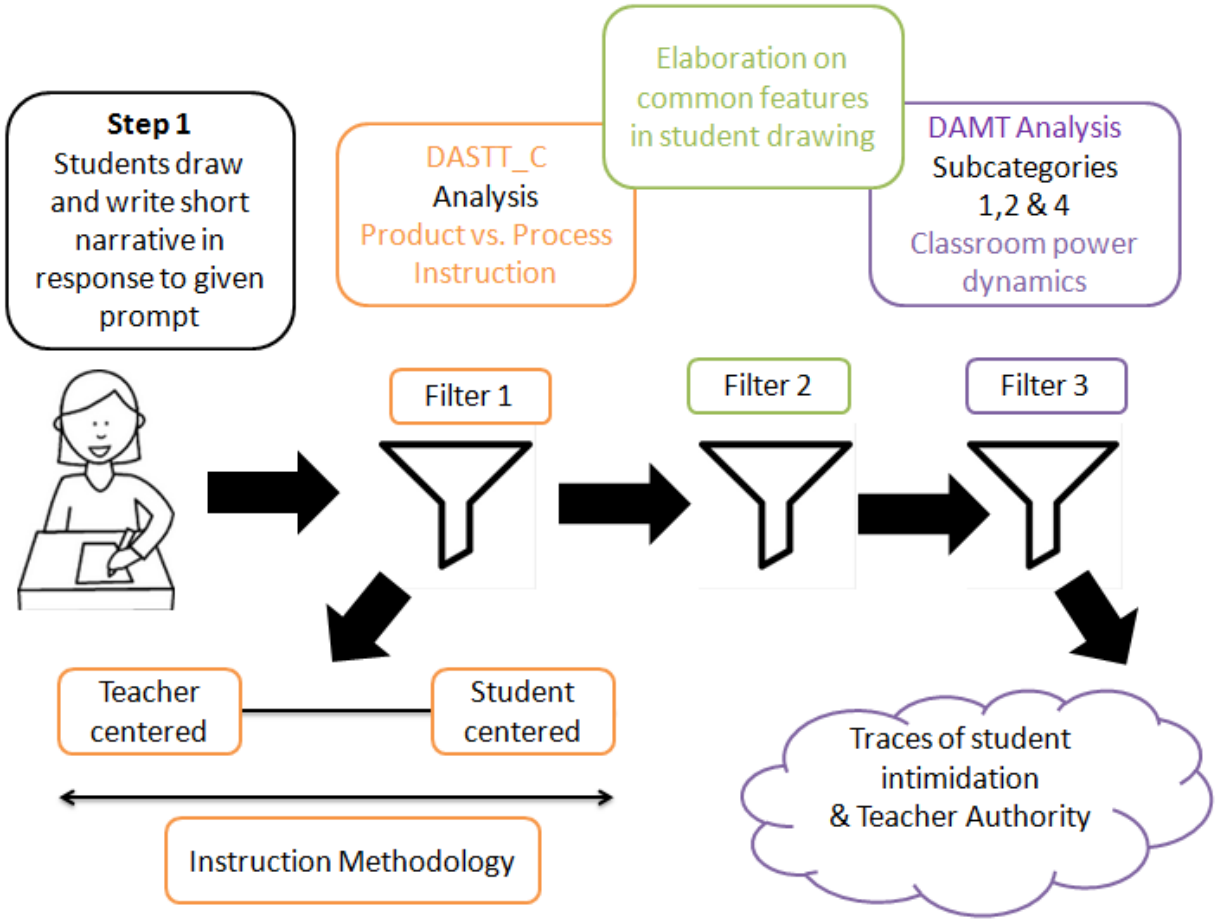

Figure 4.3. Re-adjusting Analysis Methodology.[2]

As illustrated in Figure 4.3, the analysis methodology has been adjusted to include an additional filter. This filter mainly serves as a mirror to the most common features in students' drawings. Tables 4.5 and 4.6 present the results of the integration of the additional feature for both classes.

1) [2] References for the cliparts in the figure are the same as those for Figure 4.2

Table 4.5

Additional Filter Results for Class 1

Most common Features	Girls (Class 1)												Boys (Class 1)															
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Drawing includes students	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	y	y	y	n	n	y	n	n	y	y	y	n	n	y
Drawing shows teacher desk	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
Gender of teacher	m	m	f	m	m	m	m	f	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
Basic arithmatic on board	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	n	n	n	n	y	y	y	y	n	y	y	y	y	n
Teacher smiling	y	y	y	y	y	n	y	y	n	y	y	y	y	y	n	y	n	n	n	y	y	y	y	n	y	n	y	y	y

Table 4.6

Additional Filter Results for Class 2

Most common Features	Girls (Class 2)													Boys (Class 2)																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Drawing includes students	y	n	n	n	n	n	y	n	n	n	n	y	n	n	n	n	y	n	n	y	y	y	y	y	y	y	n	n	n	n	n	n
Drawing shows teacher desk	n	n	n	n	n	n	n	n	n	y	n	y	y	n	n	n	y	n	n	n	n	y	n	n	n	y	n	n	n	n	n	n
Gender of teacher	m	m	m	f	m	m	m	m	f	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
Basic arithmatic on blackboard	n	n	n	n	y	y	y	y	y	n	y	y	n	y	y	y	y	y	y	y	y	n	n	n	n	n	y	y	y	y	y	n
Teacher smiling	y	y	n	y	y	n	y	y	y	n	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y

Note : ‘n’ denotes ‘no’, ‘y’ denotes ‘yes’; ‘m’ denotes ‘male’& ‘f’ denotes ‘female’

4.2. Summary of main findings of DASTT_C Analysis

Overall there are 61 participants in this study, 25 of which are female and 36 are male.

The main findings include:

- The most commonly depicted figure is that of a male teacher centrally located in front of the blackboard. The drawing shows no students. The teacher is smiling. 57% of all students in both classes drew this same image. That's 72% of the girls and 47% of the boys. The fact that the same drawing was common across both classrooms indicates that this repetition in drawing cannot be only explained by the proximity in seating. It seems to be that this is the common impression most students have about the mathematics classroom instruction in School A.
- Although irrelevant to this study, however it is worth mentioning that 69% of the students associate the word mathematics with basic arithmetic functions. This is 76% of the girls and 64% of the boys. Future work may consider a further development of this finding and potentially a more elaborate cross gender exploration.
- 1.6% of the students' drawings show signs of peer work in the classroom. This can be directly attributed to the classic cultural learning and teaching environment in national schools that has been thoroughly discussed in Chapter 2.
- 69% of the students' drawings do not show any students in the drawing. The reason for that may be related to the lack of accuracy in the prompt. As mentioned, the first group was requested to draw a mathematics teacher at work. 72% of those students did not draw any students in their images. When the prompt was changed to include the words 'in the classroom' on the second day, 66% of the students still did not show the presence of students in their drawings. According to the DASTT_C analysis guidelines (Thomas,

Pedersen, & Finson, 2001), this finding highlights that the instruction methodology is mostly teacher centered. In addition to that 84% of the drawings show the teacher to be standing and centrally located, which again is a sign for the teacher centered pedagogy as per the DASTT_C analysis guidelines (Thomas et al., 2001).

- Despite the fact that the drawings underscore the presence of a teacher centered pedagogy, another statistic highlights that the teaching method is neither authoritative not intimidating to the students. 82% of the students illustrated the teacher to be smiling. That is 80% of the boys and 83% of the girls. This fact necessitates the presence of the DAMT filter that will consider student intimidation in the classroom and general power dynamics in more detail. It will hence be particularly interesting to see whether the findings of the DAMT Analysis will be in line with this finding or not. The DAMT Analysis will take place in the section 4.4 of this Chapter.
- 93% of the students presented the mathematics teacher in their drawings as a male figure. That includes the drawings of 100% of the boys and those of 84% of the girls. This finding underscores other findings in literature that associate mathematics to men rather than women (Goldstein, Schappacher & Schwermer,2007). Interestingly the figures showing the mathematics teacher to be female are only those of female students distributed fairly over the two classes where the actual teacher is a male and where the actual teacher is a female. This finding could be interesting in future elaborations of this work.
- Only 3% of the drawings show visual aids in the classrooms. As previously mentioned, the reason for that might be associated with the fact that in that particular school most visual aids are in the hallways between the classrooms

- 34% of the students present a topology of the student desk arrangement in their work. Interestingly 71% of those 34% present in their drawings a topology that is different of the actual seating order in the classroom. While the seating order in the classroom has two students sharing a desk, 71% of the students who did include the student desk arrangement show each student to be sitting separately on a desk. It appears that though the students are sitting together, few activities in the classroom involve them to actually interact with each other.
- Only 10% of the students have drawn a teacher desk. That is 12% of the girls and 8% of the boys. In addition to that, 18% of the students illustrated student desks but not a teacher desk. As previously mentioned and in accordance with the thorough explanation in the literature review about this particular cultural context, it could be deduced that the teacher is rarely sitting at his desk during the mathematics session.

Table 4.7

Summary of DASTT_C Analysis Findings

	Number of students			Percentage (%)		
	Overall	Girls	Boys	Overall	Girls Ratio	Boys Ratio
	61	25	36	100	40.98361	59.0164
Teacher						
Teacher Smiling	50	20	30	81.96721311	80	83.3333
Teacher Position:Standing & Centerally Located	51	25	26	83.60655738	100	72.2222
Male	57	21	36	93.44262295	84	100
Environment						
Lack of Visual Aid	2	0	2	3.278688525	0	5.55556
Student Desk Arrangement	21	5	16	34.42622951	20	44.4444
Presence of Teacher Desk	6	3	3	9.836065574	12	8.33333
Students						
Not Depicted	42	22	20	68.85245902	88	55.5556
Signs of Peer work	1	0	1	1.639344262	0	2.77778
Additional Features						
Most common drawing	35	18	17	57.37704918	72	47.2222
Arithmatic vs Maths	42	19	23	68.85245902	76	63.8889

The next section targets to further dwell on the feature that most students drew the teacher smiling. The section includes the analysis and findings of the third filter, the DAMT Analysis tool. Following that, a brief discussion of the overall findings will follow.

4.3. The DAMT Analysis & Findings

As already mentioned, the DAMT Analysis is a tool to measure the power dynamics in a classroom. As thoroughly discussed in Chapter 3, the DAMT Analysis includes several features that check for the level of teacher authority and student intimidation. For the sake of simplicity this work has developed questions that are based on those features. Results of this analysis are presented in Table 4.10.

Table 4.8

Findings of the DAMT Analysis

		Class 1				Class 2			
		female		male		female		male	
		yes	no	yes	no	yes	no	yes	no
1	Can you find signs of violence or the presence of violent tools in the image ?	0	12	0	17	0	13	0	19
2	Is the position of the teacher threatning to the student ?	0	12	0	17	0	13	1	18
3	Is the scale of drawing proportional (i.e. teacher size vs. student size)	12	0	13	4	13	0	18	1
4	Is the teacher seemingly standing on a stage ?	0	12	14	3	0	13	1	18
5	Is the image being ironic of the teacher ?	0	12	0	17	0	13	1	18
6	Does the figure depict the teacher to be dressed in old fashioned clothes ?	0	12	0	17	0	13	0	19
7	Can you find any form of stereotypical imagery ?	12	0	17	0	13	0	19	0
8	Are there any wizardy or cartoon symbols of teachers with special powers ?	0	12	0	17	0	13	0	19
9	Is there an unbalanced match between the students?	0	12	0	17	0	13	0	19

Results of the DAMT Analysis reveal minor traces of student intimidation. Not one figure shows any signs of violence in the classroom and apart from one figure where the student depicted the teacher punishing the students; most other drawings show the teacher to be smiling. In addition to that, apart from 5 drawings, all other drawings show the teacher and student to be at the same scale level. The teacher does not seem to be standing on a stage or taking advantage of his/her authoritative position. Two drawings even show the students standing at the board and explaining to their peers, which is a clear indicator to participatory learning. None of the images are either being ironic of the teacher or presenting him/her as having special extraordinary powers. According to Picker & Berry (2015), this means that students do not feel inferior and generally have the impression that mathematics is for everybody and not just for a selected few. This finding can be supported even more, when looking at the results of the final questions. Students see themselves as equal to each other. Not one drawing shows traces of mathematics being a subject for a selected few. Thus, from the DAMT analysis results one can deduce that there is a stable power balance in the classroom. The teacher is not being perceived as an

oppressor and similarly, the students do not show traces of intimidation and inferiority in their drawings.

4.4. Triple Filter Results Integration

This Chapter has presented a three stage analysis of students' drawings in response to the prompt of drawing a mathematics teacher at work. Findings of the first filtration stage indicate clear traces of a teacher centered pedagogy (Figure 4.4). Many drawings do not show students in the classroom. Some even show student desks without any students sitting at them and the ones that do include students, depict them as being totally isolated from each other. It seems that the students do not often experience peer work. In addition to that, most drawings show the teacher standing at the board explaining a lesson. Very few images show traces of student integration which again is an indicator for the didactic approach to teaching. Nevertheless some figures do show traces of student participation and student empowerment. Few images show the students to be standing at the board explaining to their peers. Accordingly the class pedagogy can be placed on the teacher-student centered continuum as depicted in Figure 4.4

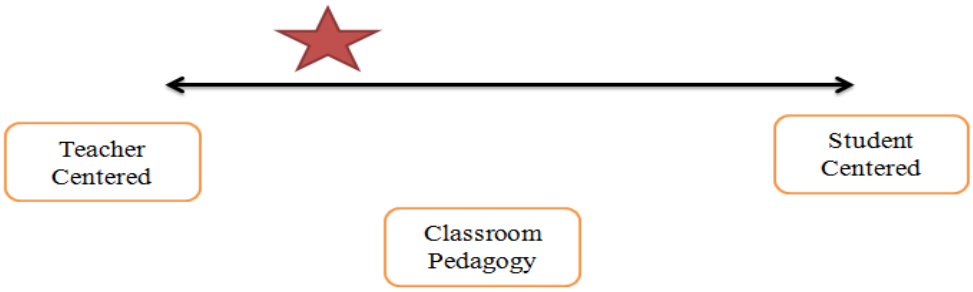

Figure 4.4. Teacher vs. Student Centered Continuum.

Interestingly however, although the classroom pedagogy is clearly more lenient towards the teacher centered approach; yet additional features as well as the results of the DAMT filter

present traces of a very balanced power dynamics in the classroom. It seems that teacher authority and teacher centered teaching are not directly proportional. In other words, if a teacher adopts a teacher centered approach this does not directly mean that this teacher is taking advantage of his/her authority to intimidate the students.

As thoroughly discussed in Chapter 2, reasons for adopting the teacher centered approach are manifold and can be directly attributed to the school culture, the parents' expectations, the teacher's own experience as a student as well as the teacher's own beliefs about proper teaching (El-Deghaidy, 2006). The teaching culture hence is linked to several cultural expectations.

This study underscores previous findings that clearly argue against the common claim that teacher centeredness directly implies an unbalanced power ratio in the classroom (Picker & Berry, 2015) . According to the findings of this study, students do perceive the classroom instruction methodology as being teacher centered, yet there are very minimal traces of teacher-student oppression. Accordingly, it becomes clearer that teacher centeredness does not directly result from an unbalanced power ratio or a desire to control but instead may be associated with teacher self efficacy and the teacher's reciprocal triadic determination (Watson, 2013). These latter two concepts are part of the social cognitive theory (Watson, 2014) where self efficacy is the belief that success in teaching will take place when the teacher acts in a certain way (Watson, 2013). Being used to the traditional teaching model, one feels more confident and comfortable in adopting this same principle. This is often referred to as reciprocal triadic determination. Hence, the choice of teacher centered instruction does not result solely from a desire to oppress and control but instead is often a result of the teacher's intention to apply the approach s/he personally is familiar with, perceives to be more effective and is expected by the school policy and other stakeholders and part-takers of the overall learning process.

CHAPTER 5

GENERAL CONCLUSION

This work has been focusing on studying preparatory school students' perception of mathematics instruction within the local context of the Egyptian teaching and learning culture. The target was to answer the following question: What insights about classroom power dynamics in the Egyptian mathematics learning context can be drawn from the analysis of preparatory local school students' drawings? The previous Chapters have presented a thorough analysis of the integration of well studied research tools as an attempt to answer the research question. This Chapter starts by first listing some limitations to the current study. Afterwards, a brief presentation of the main findings is presented. This enables the provision of an answer to the question presented at the beginning of this work. This will be followed by some recommendations for possible future extension of this work. The outline of the Chapter is presented in Figure 5.1.

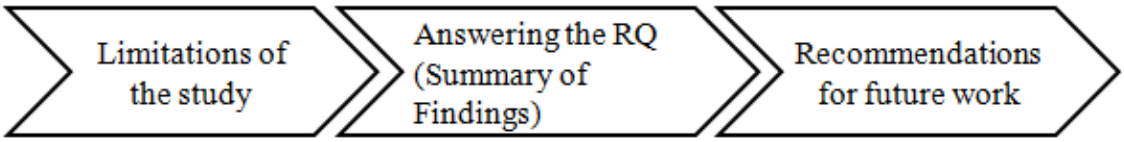

Figure 5.1. Chapter Outline

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5.1. Limitations of the study

This work aimed to consider some contextual elements that affect the learning and teaching of mathematics within the local Egyptian cultural framework. For the study to be representative of the entire local teaching and learning culture, a random sample of several schools that follow the same instruction medium needed to be selected. The research tool would then be necessary to be adopted across all of those schools to ensure that the results are representative of the overall local culture of teaching and learning. For time constraints and accessibility restrictions, it was only possible to consider one case study of a local Egyptian School. Future work can consider a wider integration of the same methodology across a wider range of schools.

Originally this study was aimed at comparing and contrasting the contextual findings of teaching and learning mathematics at local schools with those of international schools. Due to time and accessibility limitations, it was only possible to conduct the first part of the analysis.

5.2. Answering the Research Question

To start with, one can restate the research question: What insights about classroom power dynamics in the Egyptian mathematics learning context can be drawn from the analysis of preparatory local school students' drawings?

To answer this question, two well established research tools have been adopted, namely the DASTT_C tool and the DAMT tool. The first tool is primarily designed to assess teacher vs. student centeredness generally in science classrooms while the second tool is more oriented towards measuring the teacher's authority particularly in a mathematics classroom. Both tools base their methodological framework on a 15 minute student drawing prompt. The results of both tools revealed the following:

The findings of the double filter analysis were initially seemingly contradicting but a deeper consideration of the social cognitive theory provides a good explanation to the seeming paradox. Contrary to the researcher's initial expectation, the findings of the second filter do not confirm the findings of the first filter. The first drawing filter revealed most of the classroom pedagogy's authority to be in the hands of the teacher. According to the guidelines set forth by the DASTT_C (Thomas, Pedersen, & Finson, 2001), the pedagogy is clearly teacher centered. Results of the second (DAMT) filter (Picker & Berry, 2015) however did not reveal any traces of an imbalanced student-teacher authority ratio. This created the necessity to have an intermediate filtration. This intermediate filtration was developed with the help of common traces that were spotted amongst most of the drawings. One of the most common features was the feature of the teacher smiling. This feature offers an interlinking explanation that related the seeming paradox in the findings of filter 1 and filter 2 (Figure 5.2). Furthermore, this finding highlights the necessity of having two filters instead of one. Though the classroom is teacher centered, yet according to the findings in the drawings; the teacher does not seem to practice his/her authority to oppress the students. On the contrary, the students experienced the class session as a constructive knowledge building experience. In that sense, power dynamics in the classroom cannot be directly attributed to either the teacher – or the student centered approach but were rather a manifestation of other factors such as teacher beliefs and self efficacy. In other words; according to the findings; a teacher centered instruction methodology does not have to imply a lack of balance in the classroom power dynamics. Instead the presence of symptoms of teacher centered pedagogy can be explained by considering concepts of the social cognitive theory in light of an understanding of the academic cultural expectations.

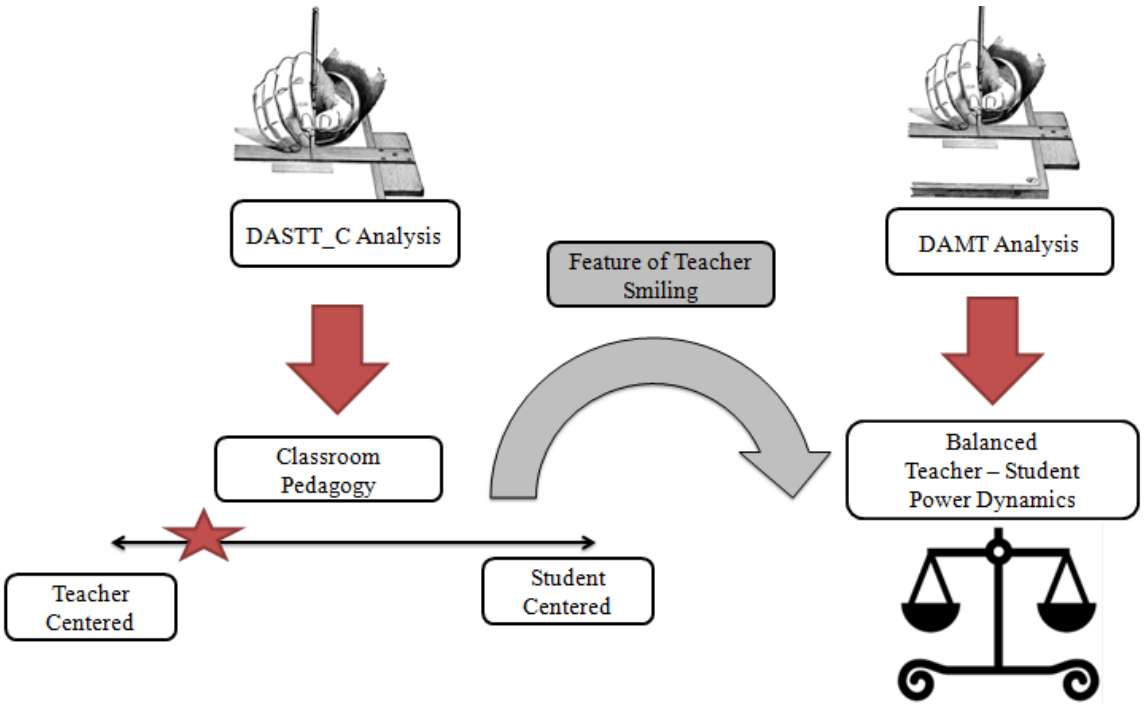

Figure 5.2. Bridging the Gap of both Filter Results

Figure 5.2 shows the seemingly contradicting findings of the first and second filter and identifies that a possible explanation of the seeming paradox lies in considering the facial expressions of the teacher as depicted by the students.

Thus, with this study in mind, one could conclude that the power dynamics in a classroom cannot be directly attributed to the adoption of either a teacher or a student centered approach. Instead, power dynamics are a product of a more complex manifestation of different cultural value systems (Bishop, 1988). A possible explanation to classroom power dynamics may result from the teacher's self efficacy and beliefs; i.e. the way the teacher perceives their own role coupled with the means the teacher perceives to be the best practices for teaching and learning. This study is an illustration of that principle. Though this study clearly revealed the classroom pedagogy to be teacher centered, yet minimal traces of an imbalanced power ratio among the

students and between teacher and student can be traced in analysis of the drawings. The teacher centered approach can hence be explained to be a simple manifestation of the cultural beliefs of school's best practices. Culturally, the school sees its role as an enforcer of discipline. Discussions with the head of mathematics division revealed that the common belief is that for students to be disciplined they need to recognize the teacher's knowledge superiority. The school leadership and the parents expect the teacher to be centrally leading the knowledge building process. Student peer work and student leadership is not encouraged as it is foreign to the overall belief system. Student leadership is considered as a lack of respect towards the teacher and peer work is considered as a lack of ability of the teacher to control his/her students. Being solely exposed to this pedagogy, the teachers also believe in the teacher centered approach. They do their best to prepare and lead their lessons in that way. This does not by any means imply that the students are disadvantaged. It is simply a manifestation of the cultural expectation of teaching and learning.

Therefore to give a brief answer to the research question at hand, it is important to note that: Power dynamics are associated with a manifestation of teacher beliefs while classroom pedagogy is a result of cultural contextual accepted teaching and learning norms. For the case study at hand, student drawings revealed a high degree of teacher centered instruction, yet at the same time also showed clear traces of a healthy teacher-student relationship. Students do not perceive their teacher as a threat. Instead most of them perceive him/her as a friendly instructor. Moreover, drawings presented a minimal manifestation of intra-power struggles between the students. Students do not perceive their peers as superior or inferior to them. Drawings do not show students' to perceive mathematics to be a subject just for a chosen few.

Figure 5.3 again summarises the answer to the research question.

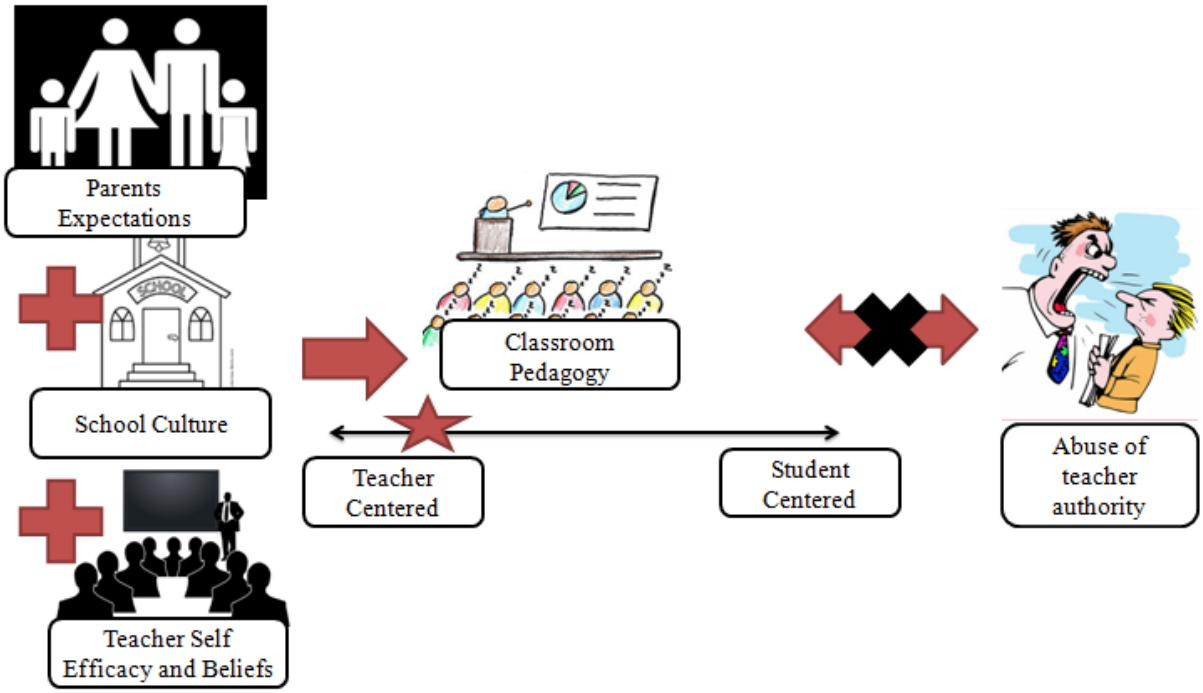

Figure 5.3. Addressing the Research Question[1]

As clearly illustrated in Figure 5.3, the classroom pedagogy for the case study at present is more lenient towards the teacher centered approach. A possible explanation to that lies in the contextual understanding of the teaching and learning culture in light of the social cognitive theory. The school culture dictates a certain teaching approach. Teachers, on the other hand perceive this pedagogy to be the best suited for the teaching of mathematics. Reasons for that are manifold and include the fact that the teachers themselves have been exposed to that system when they were students and hence feel safe re- adopting it again with their students. Another reason lies in the perception of that pedagogy as establishing respect towards the teacher and general discipline within the student body. Also parents expect their students to be taught in that way. Figure 5.3 also shows that a teacher centered approach does not directly imply an

[1] Image of the teacher authority retrieved from: https://www.google.com.eg/search?q=student+teacher+power+struggles&espv=2&biw=1366&bih=643&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiX1ZaE_qjJAhXM7xQKHZSeAFsQ_AUIBygC#tbs=itp:clipart&tbm=isch&q=teacher+authority+&imgrc=yzGUak4WqVi5FM%3A

imbalanced power ratio or an abuse of teacher authority. Instead, findings of the analysis at hand tend to show that teacher authority does not directly result from the adoption of a particular classroom pedagogy.

5.3. Recommendations for future work

Much of this study's findings are based on the fact that the teacher's facial expressions in the students' drawings were taken into consideration as part of the qualitative analysis. It would be hence recommended that teacher facial expressions would be included as an additional feature to the DASTT_C Analysis.

The analysis of the drawing also showed some traces of stereotypical associations of mathematics teachers being mostly males. Future work might consider an elaboration of this finding.

Another finding that could be also further developed in future work is that of the stereotypical association of mathematics with arithmetic. Many of the students simply drew basic arithmetic operations when asked to draw their impression of mathematics instruction. This finding was consistent across drawings of both genders. Future research could also possibly further explore that phenomenon.

Furthermore, this work can be used in the future as a component to a comparative analysis that seeks to explore differences in the contextual understanding of mathematics teaching and learning across varying cultures. For the comparative study to be effective; it needs to consider an implementation of a similar sequential double filtration methodology of a mathematics classroom in a different cultural learning environment. Results of both double filter integrations would then be contrasted. Figure 5.4 presents a possible outline of that comparative study.

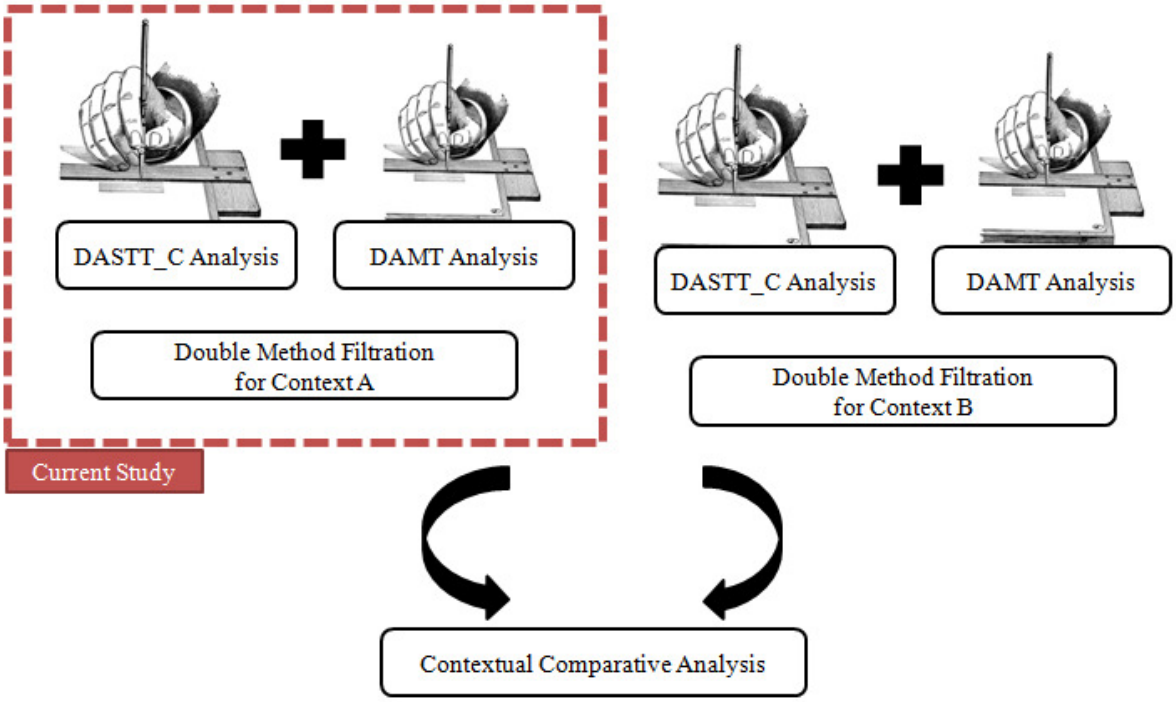

Figure 5.4. Future Work

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Appendix A

Arabic Consent Form for Legal Guardians

الجامعة الأمريكية بالقاهرة

استمارة موافقة مسبقة للمشاركة في دراسة بحثية

عنوان البحث : التطبيق المجتمعي الخاص بتدريس الرياضيات في المدارس

الباحث الرئيسي: المهندسة مريم مجدي
الهاتف الخاص بالجامعة: 26151493

انت مدعو للمشاركة فى دراسة بحثية عن تطبيق ثقافة الغرب في تدريس الرياضيات في ظل الثقافة الشرقية المصرية .
هدف الدراسة هو النهوض بطريقة التدريس في بلادنا المصرية

نتائج البحث ستنشر فى دوريه متخصصه أو مؤتمر علمي أو ربما كليهما.

المدة المتوقعة للمشاركة فى هذا البحث: مالا يكثر عن شهرين

اجراءات الدراسة تشتمل على طلب رسم من طلبة وطلبات المدارس بسن إعدادي

المخاطر المتوقعة لا يوجدمخاطر لهذه الدراسة

الاستفادة المتوقعة من المشاركة في البحث**:** اتاحة الفرصة للطالب المصري بالتعبير عن رايه فيما يختص بالمنهج التعليمي الذي يتعرض له في ظل السرية التامة.

السرية واحترام الخصوصية: المعلومات التى ستدلى بها فى هذا البحث سوف تكون سرية .

أي أسئلة متعلقة بهذه الدراسة أو حقوق المشاركين فيها أوعند حدوث أى اصابات ناتجة عن هذه المشاركة يجب ان توجه الى شخصيا . رقم الهاتف موجود بأعلى هذه الصفحة

ان المشاركة فى هذه الدراسة ماهى الا عمل تطوعى, حيث أن الامتناع عن المشاركة لايتضمن أى عقوبات أو فقدان أى مزايا تحق لك. ويمكنك أيضا التوقف عن المشاركة فى أى وقت من دون عقوبة أو فقدان لهذه المزايا.

الامضاء: .....

اسم المشارك : .....

التاريخ : ...../...../.....

CASE #2014-2015-186

THE AMERICAN UNIVERSITY IN CAIRO
INSTITUTIONAL REVIEW BOARD

To: Mariam Makramalla

Cc: Dena Riad & Salma Serry

From: Atta Gebril, Chair of the IRB

Date: August 30 , 2015

Re: Title change

This is to inform you that I reviewed your revised research proposal entitled **Contextualization of Mathematics Instruction A "Draw A *Scientist* Test (DAST)" Analysis**" and determined that it required consultation with the IRB under the "expedited" heading. As you are aware, the members of the IRB suggested certain revisions to the original proposal, but your new version addresses these concerns successfully. The revised proposal used appropriate procedures to minimize risks to human subjects and that adequate provision was made for confidentiality and data anonymity of participants in any published record. I believe you will also make adequate provision for obtaining informed consent of the participants.

This approval letter was issued under the assumption that you have not started data collection for your research project. Any data collected before receiving this letter could not be used since this is a violation of the IRB policy.

Please note that IRB approval does not automatically ensure approval by CAPMAS, an Egyptian government agency responsible for approving some types of off-campus research. CAPMAS issues are handled at AUC by the office of the University Counsellor, Dr. Amr Salama. The IRB is not in a position to offer any opinion on CAPMAS issues, and takes no responsibility for obtaining CAPMAS approval.

This approval is valid for only one year. In case you have not finished data collection within a year, you need to apply for an extension.

Thank you and good luck.

Atta Gebril

Dr. Atta Gebril
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