Teacher education of statistics from theory to practice

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Abstract

Purpose – To prepare pre-service mathematics teachers (PSMTs) in Egypt, learning statistics as a subject takes place at the faculty of science, apart from what is going on at the faculty of education. The Organization for Economic Co-operation and Development has highlighted this dilemma as follows; "Pre-service education in Egypt is characterized by a separation of theory from practice, in the belief that student teachers will put it into practice later in schools" (OECD, 2015, p. 120). The purpose of this paper is to propose a microteaching lesson study (MLS) model that bridges the gap between learning free content pedagogies and teaching statistics, consequently, enhances PSMTs' pedagogical content knowledge.

Design/methodology/approach – The ethnographic approach has been employed, and hence, the national faculty policy guidelines have been revised through Grossman's (1990) model. Moreover, a focus group of PSMTs' opinions has been investigated to interpret the aforementioned situation and provide meaningful insights.

Findings – As a result, the MLS model rooted in constructivism theory has been introduced. Furthermore, supported discourse to enhance PSMTs' pedagogical content knowledge (PCK) of teaching statistics is described.

Originality/value – The MLS model may help to change PSMTs' perception concerning the gap between theory and practice. Meanwhile, it could be an endeavor to reform PSMTs' initial views regarding what learning and teaching of statistics look like, through enhancing their PCK of teaching statistics. Furthermore, engaging them in such environments to be a part of the learning community and learn more from the experts is crucial.

Keywords Statistics, Microteaching lesson study (MLS), Pedagogical content knowledge (PCK), Pre-service mathematics teachers, Statistical knowledge, Subject matter knowledge

Paper type Viewpoint

1. Introduction

Pre-service mathematics teachers (PSMTs) who belong to mathematics education departments in the Egyptian universities (undergraduate students), learn the academic subjects (e.g. pure mathematics and statistics) in specialized science-oriented departments, separated from what is happening within the educational departments (Tanta University Committee, 2010). This helps to create a dichotomy between subject matter knowledge and pedagogy. Academic authorities tend to focus solely on mastering the mathematical content, believing that those who succeed in this regard will be able to teach that content effectively to students. Bennett and Carré (1993, p. 215) summarized this thinking as follows: "Subject-matter knowledge is a necessary but not sufficient ingredient for competent teaching performance."

Microteaching (MT) has been defined as a method that creates opportunities for pre-service teachers (PSTs) to practice a teaching method in artificial learning environments that comprise their peers as learners (Etkina, 2010). Therefore, the faculty of education's intended curriculum has stated that the purpose of MT is to address the above-mentioned diatomic situation (Faculty of Education Committee, 2015). MT should help PSMTs to put their understanding of a subject into practice. Hence, employing the combination between the content itself and its pedagogy within school practicum (i.e. school visits). However, MT sessions are usually done in a routine way where the instructors discuss general pedagogies (e.g. problem solving and brainstorming) free of mathematics content. This situation has been admitted in literature as an uninspired method and a barrier in the education of

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qualified teachers (NCTAF, 1996, as cited in Fernandez, 2005). Hence, it is not surprising that many PSMTs complain about MT sessions, agreeing that it is often taught through lectures free of mathematics content and apart from the school curriculum (Hamada, 2014). Furthermore, the Organization for Economic Co-operation and Development criticized the same situation as follows: "Pre-service education in Egypt is characterized by a separation of theory from practice, in the belief that student teachers will put it into practice later in schools" (OECD, 2015, p. 120). Therefore, there is an urgent need within the national context to review the structure as well as the content of the MT course.

This discussion raises two basic inquiries. The first is deciding which content takes priority to address within the MT course. It should be noted that there is an increasing amount of statistical content included in the school curriculum in many countries (Franklin *et al.*, 2005), Egypt as well. Interestingly, only about 9 percent of the whole content within the national teacher preparation program is concerned with statistics and probability. Furthermore, the statistics content is often neglected during the pedagogical discussion as well as during school practicum. As a result, many researchers agree that teachers should be trained adequately to prepare students to be statistically literate. Especially, the case for traditional introductory statistics courses during initial teacher education (ITE) which cannot provide mathematics teachers with the didactical knowledge they need (Batanero *et al.*, 2004; Stohl, 2005; Franklin and Mewborn, 2006, as cited in Batanero and Diaz, 2010). Consequently, the basic statistical concepts within the school curriculum could be essential to address during MT. Particularly, the general principles for other areas of mathematics cannot always be applied within the statistical context (Batanero *et al.*, 2004).

The second inquiry is how to review the structure of the MT course to be connected with the school curriculum? One strategy stands out as an example of best practice among countries (e.g. Japan) with high-achieving mathematics students – the use of lesson study (LS) as a professional development process for teachers (Stigler and Hiebert, 1999; Coenders and Verhoef, 2019). Microteaching lesson study (MLS) incorporates aspects of MT with a modification of Japanese LS phases (Curcio, 2002). It forms an experience that is designed to encourage PSTs to resolve the disparities between theory and practice (Fernandez, 2005, as cited in Molina, 2012). Furthermore, MLS provides a context to develop prospective teachers' pedagogical content knowledge (PCK) (Fernandez, 2005), which holds crucial importance for their learning process (Shulman, 1986). However, the combination of MT and LS during ITE is a recent development. Studies in that area are still few and its implication in a cultural context is rare (Cohan and Honigsfeld, 2007; Carrier, 2011; Larssen *et al.*, 2018). Moreover, few studies were conducted in statistics in contrast with many are found in mathematics and science (Fernandez and Robinson, 2006; Fernandez, 2010; MacDowell, 2010; Molina, 2012). Therefore, the current study suggests designing the MLS model as an attempt to bridge the gap between learning free content pedagogies and teaching statistics, which may enhance PSMTs' PCK of teaching statistics.

2. Literature review

2.1 Definition of MLS

LS is a form of professional development highly valued among Japanese teachers. It includes several stages: collaborative planning, lesson observation by colleagues and other knowledgeable advisors, analytic reflection and ongoing revision (Stigler and Hiebert, 1999; Lewis *et al.*, 2006). MT is a method for PSTs' development, which creates opportunities for them to practice a teaching method in artificial learning environments that comprise their peers as learners (Etkina, 2010). MT engages PSTs in intensive and focused opportunities to practice and then learn from that experience (Grossman and McDonald, 2008). Fernandez (2005) argued that the limitations of MT can be overcome by combining it with LS. Subsequently, Fernandez (2005, as cited in Fernandez, 2008) introduced the term MLS as a

pedagogical approach that draws on the elements of MT and Japanese LS. Therefore, MLS experience provides an opportunity for PSTs to link theory and practice through engaging in cycles of planning, implementation and reflecting on lessons (Fernandez, 2005; Griffiths, 2016).

2.2 MLS research within the context of mathematics initial teacher education

On the one hand, several researchers investigated the effectiveness of LS in developing prospective mathematics teachers' PCK. For instance, through implementing LS cycles, Fernandez (2010) revealed a growth in PSMTs' knowledge of teaching for developing students' mathematical reasoning. Yilmaz *et al.* (2017) showed similar results since prospective mathematics teachers' expectations of student thinking developed with practice. Gamze and Erdinc (2018) have also described the development of PSMTs' technological PCK in statistics through MLS. On the other hand, additional recent studies have identified some problems which may hinder the positive impact of LS in developing prospective teachers' PCK. For example, Da Ponte (2017) pointed out particular pending issues, such as: defining the aims and adapting LS for a specific purpose. Furthermore, the study recommended that LS in PSTs' education must have a clear formative aim. Moreover, Larssen *et al.* (2018) have indicated a lack of clarity for the definition of learning and the use of learning theory within the previous studies of LS in ITE context. Hence, their study suggested that future research needs to be more explicit about the learning process, how it can be defined and observed.

Through reflecting the aforementioned studies and clarifying some remaining issues, two important ideas have been concluded as follows:

(1) MLS has been acknowledged as an effective approach to develop PSMTs' PCK. Furthermore, PCK was defined by Shulman (1986) as "a second kind of content knowledge which goes beyond knowledge of subject matter *per se* to the dimension of subject matter knowledge for teaching" (p. 9). PCK includes not only mastery the content to be taught, but also the development of a wide range of skills for teaching that content to students through means of illustrations, examples, analogies and other teaching techniques that make the subject comprehensible to others (Shulman, 1986). Considering the functional facet of PCK, the dilemma of separating theory from practice within the context of ITE in Egypt can be interpreted as lack of PCK identity. Therefore, MLS could be a plausible practice to handle this situation.

(2) Defining MLS precisely and implementing it for a specific purpose, especially in the case of statistics, have been identified as area of future research. Moreover, there is a lack of research on MLS modification to fit ITE preparation programs.

Based on that; two research questions have highlighted through the current study:

RQ1. How can the MLS model be designed to reconcile learning free content pedagogies during MT course with teaching statistics during school visits within the context of ITE in Egypt?

RQ2. What are the relevant issues to discuss during the implementation of the MLS model to enhance PSMTs' PCK of teaching statistics?

2.3 Theoretical perspective and definition of terms

Although statistics as a domain is widely accepted, it is still taught as sub-part of the mathematics school curriculum. Therefore, there is a need to better prepare PSMTs who will be responsible for teaching statistics to various grades. In this regard, Batanero and Diaz (2010) asserted that teachers' statistical knowledge plays a significant role in the quality of their teaching, since teachers' instructional decisions are dependent on this knowledge. Consequently, several studies highlighted the importance of developing teachers'

knowledge of teaching statistics in ITE (Heaton and Mickelson, 2002; Burgess, 2009). However, statistics education research has a much shorter history and its literature regarding teacher knowledge is relatively scarce (Burgess, 2009).

From this perspective, the current study has focused on PSMTs' knowledge of content and teaching (KCT); and knowledge of content and students (KCS) which are hypothesized in Burgess's (2009) conceptualization of mathematics teachers' PCK of teaching statistics. Therefore, KCT and KCS have been defined as follows:

- KCT is PSMTs' knowledge about how to teach basic statistical concepts through implementing the following steps: define the problem, plan to solve it, collect data, analyze data, conclusion and interpretation (PPDAC cycle).
- KCS is PSMTs' knowledge about students' common understanding, difficulties and misconceptions during the acquisition of basic statistical concepts.

Consequently, MLS in this study has been defined as a pedagogical approach that can reconcile learning pedagogy theoretically within the context of MT with practicing the statistics content during practicum training in the attachment schools. Thus, enhancing PSMTs' PCK of teaching statistics.

3. Research methodology

Since the ethnographic approach focuses on the natural surroundings of cultural systems and organizations; it enables a perspicacious view of the entire phenomena, including an understanding of their complexity and making generalizations on human behavior (Shkedi, 2003). Therefore, this approach has been employed to describe the local situation of PSMTs who belong to the Mathematics Education Department, at the Faculty of Education, Tanta University in Egypt, from a cultural point of view. Consequently, to answer the research questions, archival research as a mode of data collection relevant to the ethnographic approach (Angrosino, 2007) has been considered through revising the faculty of education's academic program (2010) and results of Egyptian students' achievement in the International Mathematics and Science Study (TIMSS), respectively. While the former provides a clear report about the intended subjects for PSMTs to study, which helps to deduce the focal and disregarded areas in their preparation from a national perspective, the latter helps to interpret how this situation could be relevant to students' achievement. Furthermore, an online semi-structured questionnaire has been prepared by the researcher to review recent graduate students teachers and PSMTs' satisfaction with the current structure and content of the preparation program (more details about the procedures for data collection and analysis processes in "Results and discussion" part).

4. Results and discussion

4.1 To answer the RQ1, the following four points have been considered

4.1.1 Recent graduate students teachers and PSMTs' satisfaction with the national preparation program. A convenience sample (Lopez and Whitehead, 2013) of 24 recent graduate students and PSMTs have invited to participate in the study because they are conveniently available with regard to access the online questionnaire, time and willingness. In total, 13 of them are working in private schools since they already got a teaching license after graduation, and 11 were in their fourth year of the preparation program when they are practicing teaching practicum. They responded to an online semi-structured questionnaire which included two questions. The main purpose was to investigate to what extent they feel satisfied with the current structure of the preparation program.

The first question was "Which aspect of your preparation has a significant impact during teaching mathematics, in the real classroom or the teaching practicum?" The participants' responses are represented by Figure 1.

On the one hand, around 71 percent of the participants (i.e. 17 participants) acknowledged that pedagogical courses (e.g. teaching methods, curriculum, teaching practicum and MT) are the most helpful in real practice. Their responses, in general, have been expressed as follows: "I have benefited from the pedagogical courses and MT particularly. It helps us to teach effectively during the real interaction with our students."

On the other hand, one-fourth of the participants (i.e. six participants) emphasized the significance of the academic subjects (e.g. pure mathematics and statistics). In addition, the participants gave some explanations which reflect their own beliefs about the gap between university mathematics, and school mathematics, for example:

- Student A commented: "I didn't recognize the importance of taking that advanced courses of mathematics. Although, the pedagogical part helped me to know more about how can I teach."
- Student B stated: "I forgot all of the university mathematics after graduation because it is much far from the real fieldwork."

The second question was: "To what extent do you feel satisfied with the current status of the MT course?"

In general, nearly all the participants (i.e. 21 participants) declared that they are not satisfied with the structure and discourse of the MT course, for instance:

- Student C commented: "There is no obvious vision concerning the issues which we should discuss during this course. Therefore, what we learn depends on what the instructor proposes, even if it is theoretical content or quite distant from the school curriculum." Student D also asserted: "We need preparation for teaching school mathematics, given that MT sessions are not related to school mathematics."
- Student E positively appraised MT: "We need the instructors to help us to bridge the gap between pedagogy and real teaching by explaining specific mathematical examples." Furthermore, Student F noted: "We need actual guidance and authentic assessment to improve the quality of our teaching."

In the light of participants' responses, two critical issues can be interpreted and expressed via Figure 2.

According to the participants, the first problem is "Academic Preparation" where they admitted that university mathematics content is not well synced with the school mathematics. Furthermore, the second problem concerns "Pedagogical Preparation." Although the participants strongly agreed with the importance of pedagogical courses, particularly the MT, they highlighted the gap between the MT discourse and the school curriculum.

In the light of these results, the proposed MLS model intended to tackle the second problem concerning the identified gap between the MT discourse, where the instructors

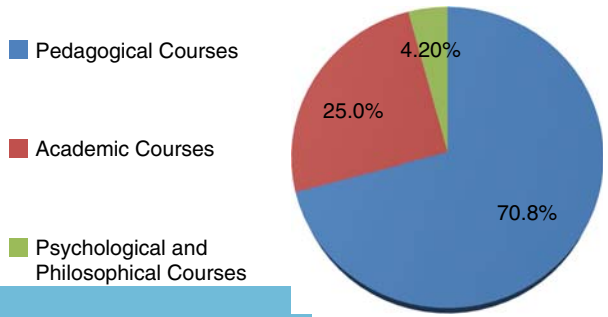


Figure 1.
Participants' opinions regarding the importance of preparation program different aspects

usually discuss general pedagogies, and teaching practicum, where PSMTs are required to teach statistics lessons that embedded within the school curriculum.

4.1.2 The content of the MLS model. To determine which content has the priority to be transmitted through the MLS model, the following national documents have been revised.

National faculty policy guidelines. The procedures of revising the national faculty policy guidelines have theorized Grossman's (1990) model of the teacher knowledge base, and the scope of each subject that PSMTs study during the entire preparation program. Hence, a quantitative analysis has been conducted to classify these subjects and deduce which content is less emphasized. Figure 3 demonstrates the studied hours for each aspect during the whole program's duration and how it corresponds to Grossman's model.

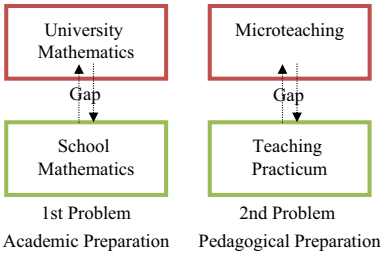


Figure 2.
Participants' opinions about the problems of the preparation program

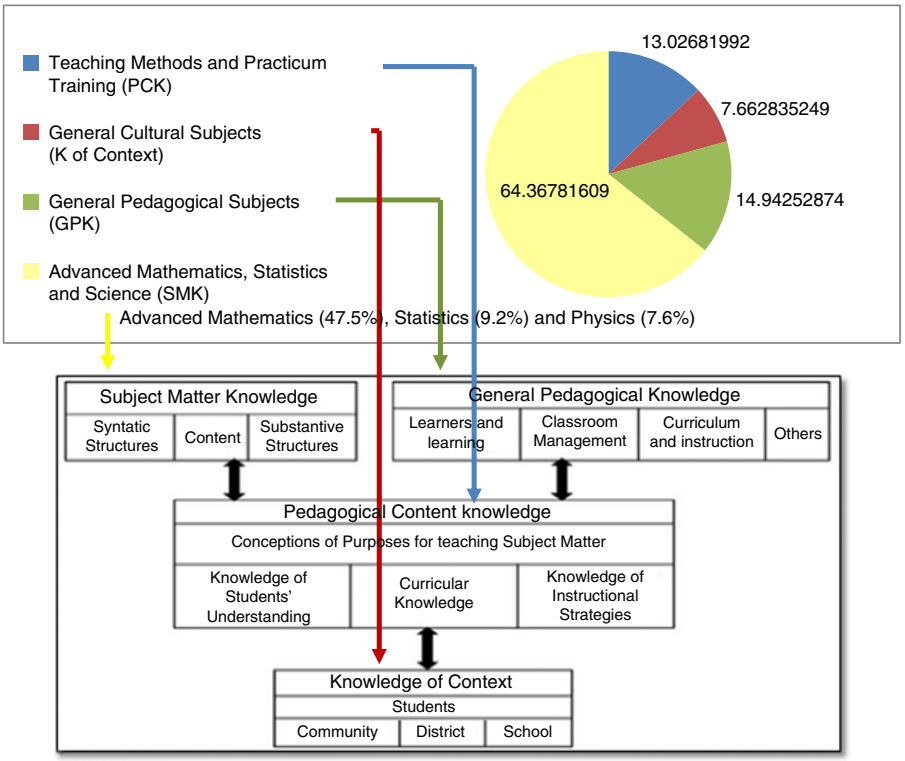


Figure 3.
The relative importance of national faculty subjects measured by the number of hours

Source: Grossman (1990, p. 5)

These results reveal that; there is more emphasis on learning advanced mathematics and general pedagogies compared to learning how to teach specific content (i.e. PCK). Moreover, the percentage of hours provided to PSMTs to learn statistics as a subject is only 9.2 percent of the whole duration.

TIMSS results. Egypt participated in TIMSS 2003 and 2007. From Figure 4, it is clear that Egyptian students' achievement in the area of "Data and Chance" is the lowest among other mathematics content areas.

Based on the preceding discussion, the overarching goal of the proposed MLS model in this study is to enhance primary school students' statistical literacy.

4.1.3 Constructivism theory as a basis to construct the MLS model. MLS is a theory-based model that depends mainly on constructivism. "Constructivism represents one of the big ideas in education. Its implications for how teachers teach and learn to teach are enormous. To date, a focus on student-centered learning may well be the most important contribution of constructivism" (Bada, 2015, p. 66). Therefore, building the MLS model in the light of constructivism theory can address what Larssen *et al.* (2018) criticized; the lack of clarity of learning theory within MLS associated research. Besides, enhancing PSMTs' PCK.

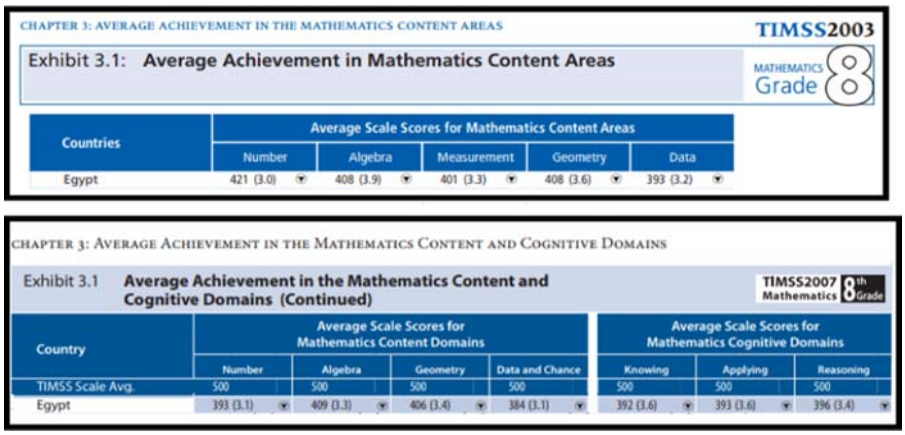
The following discussion summarizes the fundamental principles of constructivism theory and how the MLS model considers these principles:

- First principle (learning process): learners construct their further understanding using current knowledge that can adjust to accommodate with the new experience (Hoover, 1996, as cited in Amineh and Asl, 2015).

  In that sense, it is important to build on PSMTs' prior understanding of the essential statistical concepts during the step of sharing the overarching goal.

- Second principle (teaching process): constructivist teachers should provide students with opportunities to test the adequacy of their current understandings. Besides, sufficient time is needed to help the students to reflect on their new experiences and connect it with previous ones (Hoover, 1996; Prawat, 1992).

  Consequently, MLS experts (i.e. teacher educator, classroom mathematics teacher and school supervisor) should foster PSMTs' thinking and encourage them to construct meaningful activities, instead of simply following the textbook. Meanwhile, by giving PSMTs the opportunity to negotiate their thoughts as a group, the instructor enriches



CHAPTER 3: AVERAGE ACHIEVEMENT IN THE MATHEMATICS CONTENT AREAS

TIMSS2003

Exhibit 3.1: Average Achievement in Mathematics Content Areas

MATHEMATICS Grade 8

Countries	Average Scale Scores for Mathematics Content Areas				
	Number	Algebra	Measurement	Geometry	Data
Egypt	421 (3.0)	408 (3.9)	401 (3.3)	408 (3.6)	393 (3.2)

CHAPTER 3: AVERAGE ACHIEVEMENT IN THE MATHEMATICS CONTENT AND COGNITIVE DOMAINS

Exhibit 3.1 Average Achievement in the Mathematics Content and Cognitive Domains (Continued)

TIMSS2007 Mathematics 8th Grade

Country	Average Scale Scores for Mathematics Content Domains				Average Scale Scores for Mathematics Cognitive Domains		
	Number	Algebra	Geometry	Data and Chance	Knowing	Applying	Reasoning
TIMSS Scale Avg.	500	500	500	500	500	500	500
Egypt	393 (3.1)	409 (3.3)	406 (3.4)	384 (3.1)	392 (3.6)	393 (3.6)	396 (3.4)

Source: www.iea.nl/timss

Figure 4.
Eight grade Egyptian students' achievement in TIMSS 2003 and 2007

the dialogue between them. It is also recommended that MLS experts should critically and regularly analyze PSMTs' actions. Not only to assess the impact of the MLS, but also to give PSMTs important feedback which supports their learning. Different types of data can be observed, for example; audio-taped group discussion, videotaped MT sessions and teaching practicum, PSMTs' notes, research lessons and PSMTs' reflective report of what they have learned through processing MLS model.

- Third principle (cognitive growth): according to social constructivism, cognitive growth occurs first on a social level then occurring within the individual. The roots of individuals' knowledge found in their interactions with surroundings before they internalize this knowledge (Vygotsky, 1978, as cited in Amineh and Asl, 2015).

Based on that, helping PSMTs to build their knowledge (i.e. KCT and KCS) demands to work within groups of different views and cognitive levels. Hence, almost all MLS model steps must consider collaborative work. Moreover, it is also necessary to make sure that PSMTs belong to different attachment schools where they are doing teaching practicum and learn from different school supervisors. Therefore, to a certain extent, it can guarantee the diversity of experience and points of views.

4.1.4 The procedures of MLS model. To construct the MLS model; two points have been admitted.

The local context of ITE in Egypt. The PSMTs' preparation program at the Faculty of Education, Tanta University, consists of four years to get a bachelor's degree with a specialization in mathematics education. Although during the first two years learningadvanced mathematics is more emphasized. Starting from the third year, besides these mathematics courses, PSMTs are engaged in teaching practicum andMT once weekly. Consequently, MLS experts could be the university instructor who is responsible for teaching PSMTs how to teach; school supervisor who guides and evaluates PSMTs' practices during teaching practicum; and classroom in-service mathematics teacher who observes to give them relevant feedback.

The international context of LS in ITE. To ensure the consistency of MLS model's design with the international context, several studies regarding LS implementation in ITE have been reviewed (Fernandez, 2005; Fernandez and Robinson, 2006; Iksan *et al.*, 2014; Griffiths, 2016; Utami and Nafiah, 2016; Yilmaz *et al.*, 2017). Subsequently, the seven circular steps of MLS model have been expressed through Figure 5.

The MLS implementation process includes the following steps:

(1) Sharing the overarching goal: since one crucial difference between MT and MLS is the purposely selected content. Hence, enhancing primary school students' statistical literacy is the overarching goal for implementing MLS model within the current study. PSMTs should investigate the intended learning objectives. Then, the students' textbook should be analyzed to identify the basic statistical concepts across grades. The instructor discusses the term "Statistical Literacy" which includes the necessary skills for understanding statistical information (e.g. being able to organize data, construct and display tables and work with different representations of data). Statistical literacy also includes an understanding of concepts, vocabulary, symbols and probability as a measure of uncertainty (Garfield and Ben-Zvi, 2004). During this step, PSMTs should be encouraged to explain their thoughts regarding how to enhance students' statistical literacy.

(2) Planning: in this step, the PPDAC cycle should be clarified as a pedagogical approach to enhance students' statistical literacy and deepen their understanding of basic statistical concepts (Wild and Pfannkuch, 1999). Consequently, PSMTs involve in group work to develop their first research lesson considering the school's curriculum and PPDAC cycle.

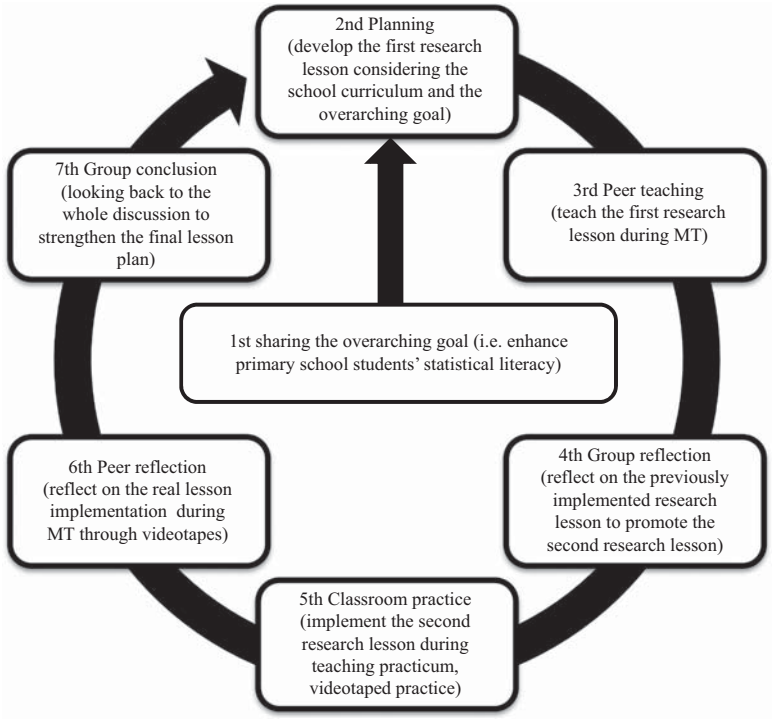


Figure 5.
MLS model

(3) Peer teaching: one PSMT implements the first research lesson during MT session while his peers in the same group, his classmates in other groups, and the instructor, observe his practice and take some notes.

(4) Group reflection: after MT session, each group reflects on their practice and their partners' practices. Then, modify the first research lesson. At the end, they prepare the second research lesson.

(5) Classroom practice: in this step, the second research lesson should be taught by another PSMT and videotaped. Meanwhile, the instructor, classroom mathematics teacher and school supervisor who are MLS experts observe and provide meaningful feedback.

(6) Peer reflection: all groups engage in analyzing the previously recorded videotapes to reflect on the real practice of their colleagues and give them the necessary feedback. Besides, identifying how implementing the same lesson for diverse students can create different results.

(7) Group conclusion: finally, each group reviews the whole previous argumentations for promoting their final lesson plan. Accordingly, the proposed MLS model engages PSMTs in two combined cycles of planning, implementation and reflection; the first within an MT session while the second during the teaching practicum.

4.2 To answer the RQ2

Table I highlights some guided questions that are suggested to address during the implementation process.

MLS model steps	Guided questions
Sharing the overarching goal	What does statistical literacy mean? What are the prominent concepts that are embedded within the statistics units of primary school mathematics curriculum? What are your thoughts to enhance students' statistical literacy?
Planning	What are the intended learning objectives students expect to achieve according to the national school curriculum? To what extent do these objectives match the MLS overarching goal? How can a statistics lesson be designed using the PPDAC cycle? What are the characteristics of learning activities that could enhance students' statistical literacy? What are the prior concepts students should understand to be able to tackle further activities? What are the predicted common difficulties and misunderstandings that may occur when students encounter the intended activities?
Peer teaching	Do the intended learning objectives, activities and assessment techniques can enhance students' statistical literacy? How to judge students' statistical literacy promotion?
Group reflection	How to modify your 1st research lesson to fit more with the main goal of enhancing students' statistical literacy? What are your plans to overcome students' expected difficulties that may arise during the 1st research lesson's implementation? What did you consider from your colleagues' and the instructor's feedback to better prepare the 2nd research lesson?
Classroom practice	The observers are recommended to record some notes about What were students' powerful ideas, difficulties, and misconceptions that emerge during the real practice of the 2nd research lesson? Is that possible to use any technological tools (e.g. statistical software) to overcome some challenges related to students' misconceptions? How did PSMTs who performed the 2nd research lesson manage the classroom, organize the time, and engage students in different activities? To what extent did the PSMTs' discourse influence students' statistical literacy? How can you evaluate the effectiveness of the 2nd research lesson (objectives, activities, teaching materials and assessment techniques) in enhancing students' statistical literacy?
Peer reflection	Do you think that your colleague's responses could help the students to overcome their difficulties? What are the critical limitations that you could not overcome within the real classroom? What could you learn from these limitations to improve your next practice?
Group conclusion	What did you learn from your peers, instructor, classroom teacher and school supervisors' feedback to better prepare your final lesson plan? To what extent are these different feedbacks consistent with one another? How can your final lesson plan more focused on enhancing students' statistical literacy in comparison to the 1st and 2nd research lesson?

Table I.
Guided questions to address during the implementation of the MLS model

In addition to the above-mentioned questions, some techniques could be adopted to evaluate PSMTs' PCK, for example:

- PSMTs' discourse, peer teaching, and classroom practices should be recorded regularly to analyze how their PCK improved gradually.
- PSMTs' notes to assess peers' performance in terms of representations, examples, language, proposed questions and students' reactions and responses.
- Reflective report for each group to describe how they improved the final lesson plan for enhancing students' statistical literacy?

- Individual reflective report (self-evaluation) to explain how each PSMT benefitted from processing MLS model steps?
- Experts' professional commentary to describe how did PSMTs' knowledge improve?

5. Conclusion

The purpose of the MLS model is to bridge the gap between learning theoretical pedagogies and teaching statistics for PSMTs in Egypt. Through its implementation, PSMTs may change their perception about the gap between MT course, and what they are required to teach during the teaching practicum. As Innabi (2014, p. 4) noted: "In Arab countries, there is a gap between the theoretical view of teaching statistics and students' learning of statistics." Therefore, by addressing students' statistics literacy, this model can be a step toward improving statistics education, especially in the Arab countries. Meanwhile, from an international perspective, the MLSmodel could be an endeavor to reform PSMTs' initial views regarding what learning and teaching of statistics look like, through enhancing their PCK of teaching statistics. Furthermore, engaging them in such environments to be a part of the learning community and learn more from the experts is crucial. Finally, the MLS model tackledone of the critical points mentioned inprevious studies (implementing LS in ITE context changes the focus of students' learning to teachers) through emphasizing PSMTs' KCS. In that sense, interested faculties and departments could benefit from its structure to connect between MT (i.e. theory) and school visits (i.e.practice) which may positively impact PSMTs' PCK.

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