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**Title of paper: Didactical Situations in Mathematics: Student Teachers’ difficulties in implementing learner-centred approaches in Rwandan Secondary Schools**

# Abstract

This paper presents levels of difficulty and explanations of 19 student teachers reported while implementing learner-centred approaches during their internship in secondary schools. Data were collected and analyzed according to the research question of “what level of difficulty do student teachers report while implementing learner-centred approach in teaching mathematics?Thirteen situations were surveyed using Likert-scale questionnaire from one to five where one indicates no difficulty and five indicates extreme level of difficulty. Descriptive statistics and content analysis were used to analyse the data. Explanations provided by the student-teachers while responding to the questionnaire allowed me to identify the challenges that the mathematics student teachers are facing during their teaching practice. Implications and recommendations for future research are presented.

# Keywords

Didactical situations, teaching practice, mathematics teachers, student teacher, learner-centred approach

# Introduction

This study is a follow up of how mathematics student teachers are experiencing the teaching practice of mathematics during internship and action Research in secondary schools. Internship and action research is 120 credits period spent in secondary schools to complete their training as mathematics teacher.

During this period, Lecturers of University of Rwanda – College of Education (URCE) regularly visit interns to monitor their teaching practices and assist and supervise them in conducting their action research project. The data analysed in this paper have been collected during the visits that the URCE Lecturers did in February 2014.

# Literature review

This review concerns mainly the theory of didactical situations in mathematics as described by Brousseau (1997, 2004). In this theory, a *didactical situation* is a situation in which there is a direct and an indirect manifestation of a will to teach. In such didactical situation, one can identify at least a problem-situation and a didactical contract. In order to be source of learning, *a problem* has to fill four conditions as set by Douady (1991). Firstly, the statement of the problem, that is, the context and questions of the problem, has to have meaning for the pupils. Secondly, the pupils cannot solve the problem completely for diverse reasons such as the procedure considered is too long, it causes errors, or it has to be used outside of its known field of validity; this condition concerns especially constraints that have to be included in the problems. Thirdly, the knowledge aimed at by the learning – content or method – is made up by tools adapted to the problem; and fourthly, the problem can be formulated in at least two different settings. This fourth condition concerns representations in which the problem has to be interpreted or translated from one representation to another in order to promote learners’ understanding. Concerning the *didactical contract*, it is made of the specific habits of the teacher that are expected by the student and the behaviour of the student that is expected by the teacher (Brousseau, 1997). Having in mind the didactical contract, in a teaching and learning situation, prepared and delivered by a teacher, the student generally has the task of solving the mathematical problem she/he is given. However the access to the embedded knowledge is done “through interpretation of the questions asked, the information provided and the constraints that have been imposed, which are all the constants in the teacher’s method of instruction” (ibidem, p.225). Other concepts underlying the theory of didactical situations in mathematics are the devolution, the adidactical situation, the didactical situation, the institutionalisation, the milieu, and the adidactical milieu. The interested reader can find the definitions of these concepts in Brousseau (1997, 2004) and in other readings belonging to what is identified as ‘the French school’ (Artigue, 1994; Brousseau & Gibel, 2005; Douady, 1991; Laborde & Perrin-Glorian, 2005). The author of this paper used this theory during his doctoral studies and is interested in pursuing this endeavour (Habineza, 2013).

Another concept appropriate to this paper is the milieu. According to Brousseau (1997), a *milieu* is “everything that acts on the student or that she acts on” (p. 9). On her side, Laborde (1994) specified that the milieu consists of “all elements of the environment of the task on which students can act and which gives them feedback of various kinds on what they are doing” (p. 156).

In relation to the milieu, Brousseau defined the *adidactical milieu* as “the image, within the didactical relationships, of the milieu which is ‘external’ to the teaching itself; that is to say, stripped of didactical intentions and presuppositions” (p. 229, italics in original). In this way, the adidactical milieu is about representation of future relationships between the real situations when the student will have finished his or her studies and what he or she is doing at the present moment in the classroom.

With regard to the situation and the problem-situation, Brouseau (1997) used the term *situation* to designate “the set of circumstances in which the student finds herself, the relationships that unify her with the *milieu*, the set of ‘givens’ that characterise an action or an evolution” (p. 214, italics in original). The following diagram shows the various interactions between the teacher and the system of the student and the milieu. The arrows made with “dots” and those with “filled line” show respectively the temporary and the constant interactions between the three components of the whole system of the teacher and the subsystem of the milieu and the student.



A representation of the classroom cultural system (Brousseau, 1997, p. 56, with errata corrected as indicated in <http://www-didactique.imag.fr/Brousseau/BrousseauErrataUK.html>) as pointed out by Schoenfeld (2012).

Considering what is presented above, one can wonder whether this system is implementable without difficulty in a mathematical lesson in other contexts such as the Rwandan context.

# Research question

 The following research question guided the research reported in this paper:

What level of difficulty do student teachers report while implementing learner-centred approach in teaching mathematics?

# Methods

The design for this research study is a survey. It uses descriptive statistics and content analysis. A questionnaire has been used to collect student teachers’ judgments about difficulties they are facing while implementing the learner-centred approach in schools. According to Cohen, Manion and Morrisson (2007), surveys “gather data at a particular point of time with the intention of describing the nature of existing conditions, or identifying standards against which existing conditions can be compared, or determining the relationships that exist between specific events.” (p. 205). Surveys vary in their levels of complexity from those that provide simple frequency counts to those that present relational analysis. Our survey is of the category that provides simple frequency counts and descriptive statistics.

## Sample: Setting and Participants

The 19 student teachers who were involved in this study have already finished three years of study at University of Rwanda – College of Education preparing themselves to become mathematics teachers in secondary schools. They are completing their fourth year by doing internship and action research in schools. At the completion of their studies they will graduate as degree holders of Bachelor of Education (Mathematics).

At the time of the survey, they had spent 4 months in schools observing and practicing the teaching of mathematics. They remain with other 5 months to spend in schools practicing the teaching of mathematics and conducting their action research projects.

## Survey Instrument

The instrument used in conducting the study was a 13-items questionnaire consisting of five Likert scale. It has been inspired by the instrument used by O’Connor, Greene and Anderson (2006). The respondents were asked to rate the difficulty they experienced during the following situations that are parts of the implementation of learner-centred approach. These are:

|  |  |
| --- | --- |
| **Identifiers** | **Situations** |
| N0. 01 | Using all time learner-centred approach in Teaching and learning mathematics |
| No. 02 | Connecting new lesson to previous lesson |
| No. 03 | Connecting students’ life experience to school mathematics |
| No. 04 | Preparing mathematical problems which are source of new learning |
| No. 05 | Allowing students work individually or in small groups on a mathematical problem |
| No. 06 | Sitting in a corner while waiting for students finish solving the mathematical problem |
| No. 07 | Monitoring the work of each and every student or small group |
| No. 08 | Allowing students or small groups present their answers to give to the given problems |
| No. 09 | Allowing students compare their answers |
| No. 10 | Allowing students synthetically summarise the learnt mathematical knowledge |
| No. 11 | Correcting or completing the students’ summary of the learnt mathematical knowledge |
| No. 12 | Reflecting on the teaching and learning process and evaluating the lesson |
| No. 13 | Planning for the next lesson basing on the findings of the previous |

A rating scale of five-points was used. The number one indicated “no difficulty”, two indicated “low level of difficulty”, three indicated “moderate level of difficulty”, four indicated “high level of difficulty” and five indicated “extreme level of difficulty”.

After each question, a space was available for the respondent to explain his/her reason for choosing that level of difficulty.

## Procedures and Data Collection

The questionnaire was brought to student teachers by a lecturer of the university of Rwanda-College of Education that was designated to supervise the student teacher. After the student teachers had completed to rate the items the URCE Lecturer or the representative of the student teachers interning in a given school brought to me the questionnaire.

## Data Analysis

Data from the surveys were analysed using descriptive statistics and also using qualitative analysis techniques, specifically the content analysis.

Descriptive statistics were calculated for the thirteen survey questions. Means, Modes and Skewness were specifically calculated and used in this study. The Statistical Package for the Social Sciences (SPSS) Version 17.0 was used to calculate the mentioned statistics.

Additionally, Content analysis was used to develop categories and then count the frequency of instances when those categories occur and finally provide evidence from the data.

According to Cohen, Manion and Morrison (2007) there are several steps involved in content analysis. In this research, the steps followed were:

1) The researcher identified relevant questions to analyse; 2) The researcher developed a category coding procedure; 3) Researchers conducted the content analysis, and 4) Researchers interpreted the results.

In this research study, the items which were identified as relevant to be analysed using the content analysis were all the answers to the open question “Explain your reason(s) for choosing that level of difficulty”. These data were examined by coding and creating categories.

## Interpretation of the coefficient of skewness

If skewness = 0, the data are perfectly symmetrical. When the skewness is different from zero, Bulmer (1979) (as quoted by Brown, 2008-2011) suggested the following rule of thumb: If skewness is less than −1 or greater than +1, the distribution is highly skewed. If skewness is between −1 and − 0. 5 or between +0.5 and +1, the distribution is moderately skewed. If skewness is between −0.5 and +0.5, the distribution is approximately symmetric.

# Findings

Data were analyzed according to the guiding research question of what level of difficulty do student teachers report while implementing learner-centred approach in teaching mathematics?

 The findings are organized according to the 13 situations which are elements of learner-centred approach. I start by presenting two tables. The first table contains the frequency distributions of the answers for each situation rated using Likert scale. The second table presents the corresponding statistics, namely the mean, the mode and the skewness coefficient as calculated using SPSS Version 17.

Table No 1. Table of Frequency distribution

| **Identifier of Situations** | **Frequencies**  |
| --- | --- |
| 1 | 2 | 3 | 4 | 5 |
| **01** | 3 | 6 | 7 | 3 | 0 |
| **02** | 7 | 8 | 2 | 2 | 0 |
| **03\*** | 5 | 6 | 2 | 4 | 1 |
| **04** | 3 | 9 | 3 | 4 | 0 |
| **05** | 11 | 5 | 3 | 0 | 0 |
| **06** | 1 | 3 | 2 | 8 | 5 |
| **07** | 9 | 4 | 5 | 1 | 0 |
| **08** | 8 | 4 | 4 | 2 | 1 |
| **09** | 9 | 4 | 1 | 2 | 3 |
| **10** | 8 | 5 | 2 | 3 | 1 |
| **11\*** | 9 | 4 | 4 | 1 | 0 |
| **12\*** | 10 | 5 | 3 | 0 | 0 |
| **13** | 9 | 6 | 2 | 2 | 0 |

(\*) one data missing

Table No. 2. Table of statistics by situations

| **Statistics by situation** | Mean | Mode | Skewness coefficient  |
| --- | --- | --- | --- |
| **01** | 2.53 | 3 | -0.083 |
| **02** | 1.95 | 2 | 0.930 |
| **03\*** | 2.44 | 2 | 0.504 |
| **04** | 2.42 | 2 | 0.416 |
| **05** | 1.58 | 1 | 0.937 |
| **06** | 3.68 | 4 | -0.806 |
| **07** | 1.95 | 1 | 1.149 |
| **08** | 2.16 | 1 | 0.791 |
| **09** | 2.26 | 1 | 0.890 |
| **10** | 2.16 | 1 | 0.857 |
| **11\*** | 1.83 | 1 | 0.784 |
| **12\*** | 1.61 | 1 | 0.852 |
| **13** | 1.84 | 1 | 1.061 |

 (\*) one data missing

From the two tables above, I can draw the following observations.

**Situation No. 01: Using all time learner-centred approach in teaching and learning mathematics**

The first item related to seeking at what extent student teachers find difficult to use all time learner-centred approach in teaching and learning mathematics had a mean of 2.53. This is between the low level of difficulty and the moderate level of difficulty. The mode – the more frequent occurrence - of the distribution is at the moderate level of difficulty evoked by 37% (n=7). The distribution is negatively skewed (skewness coefficient is -0.083). As the skewness is between -0.5 and +0.5, the distribution is almost symmetric.

The level of “no difficulty” was indicated by 16% (n=3). The level of low difficulty was indicated by 32% (n=6). The level of high difficulty was indicated by 16% (n=3). None of the student teachers indicated the level of extreme level of difficulty.

In this paper, I will comment only on the levels of moderate difficulty, high difficulty and extreme difficulty if they are evoked by some of the student teachers. I will also comment of the skewness coefficient only when it is negative.

The student teachers who had moderate level of difficult evoked the time consumption of the learner-centred approach (“This method is time consuming and is not easy at all”; “this method is time consuming”; “...because the problem we meet is time management when learner-centred approach is applied”).

Two of the three who expressed having high level of difficult evoked time and class of big size (“…the students have not time to do…”; “…learner-centred takes long time and you could not finish the programme at time. When you have a big number of students it is another issue to use learner – centred [approach] all time.” The third student teacher explained the choice of high level of difficulty by saying “because mathematics requires more attention and concentration. Sometimes they [learners] forgot the previous lesson and to discover the new is complicated”.

**Situation No. 02: Connecting new lesson to previous lesson**

The second situation related to seeking at what extent student teachers find difficult to connect new lesson to the previous one had a mean of 1.95 which is between no difficulty and low level of difficulty. The distribution mode is 2 which is at the low level of difficulty and is positively skewed (skewness coefficient is 0.930). The level of “no difficult” was indicated by 37% (n=7). The low difficulty which is the mode was indicated by 42% (n=8). The level of moderate difficulty as well as the one of high level of difficulty were indicated by 11% (n=2). The level of extreme difficulty was inexistent in this situation.

The two student teachers who expressed having moderate level of difficulty explained that his or her choice is due to fact that students do not remember what they learnt in the previous lessons (“some learners did not remember the previous lesson. This causes problems to connect the new lesson to the previous one”).

The student teachers who chose this high level of difficulty explained their difficulties by referring to the fact that student can not read or can not remember the previous lessons. (in discovery method learners have difficulty to read; they forget completely the previous lesson so that to relate to the next require effort).

**Situation No. 03: Connecting students’ life experience to school mathematics**

The third situation of connecting students’ life experience to school mathematics had an average score of 2.44 which is between low difficulty and moderate level of difficulty and is positively skewed. The level of “no difficulty was mentioned by 26% (n=5) the level of low difficulty was indicated by 32% (n=6). The level of moderate difficulty was indicated by indicated by 11% (n=2). The level of high difficulty was indicated by 21% (n=4) and the level of extreme difficulty was indicated by 5% (n=1).

The student teachers who indicated a moderate level of difficulty evoked the diversity of students (“the life of students is different”) and the motivation (“students need motivation for their better performance in mathematics”).

Those who indicated a high level of difficulty explained their choice by evoking the “lack of teaching aids”, “the demand of much energy”, mathematics is abstract”.

The one who indicated an extreme level of difficulty explained his or her choice by evoking the interests of students: “[The number of] students who wants mathematics is still low”.

**Situation No. 04: Preparing mathematical problems which are source of new learning**

The fourth situation of preparing mathematical problems which are source of new learning had an average score of 2.42 which between the low level of difficulty and the moderate level of difficulty and is positively skewed. The level of “no difficulty” was indicated by 16% (n=3). The level of low difficulty was indicated by 47% (n=9). The level of moderate difficulty was indicated by indicated by 16% (n=3). The level of high difficulty was indicated by 21% (n=4) and the level of extreme difficulty was not indicated.

 The student teachers who indicated a moderate level of difficulty evoked the “lack of materials such as students’ books” and need of students’ motivation

Two of those who indicated a high level of difficulty explained their choice by evoking the “lack of pre-prepared mathematical problems”, “the learners do not easily understand, “to get the teaching aids in mathematics which are related to real life is very difficult”.

**Situation No. 05: Allowing students work individually or in small groups on a mathematical problem.**

The fifth situation of allowing students work individually or in small groups on a mathematical problem had an average score of 1.58 which between the “no difficulty” level and the low level of difficulty and is positively skewed. The level of “no difficulty” was indicated by 58% (n=11). The level of low difficulty was indicated by 26% (n=5). The level of moderate difficulty was indicated by 16% (n=3). The levels of high difficulty and extreme difficulty were not indicated.

Two of the three student teachers who indicated the moderate level of difficulty evoked the time consumption (“it is time consuming”). The third one evoked the unavailability of teaching aids.

**Situation No. 06: Sitting in a corner while waiting for students finish solving the mathematical problem**

The sixth situation of sitting in a corner while waiting for students finish solving the mathematical problem had an average score of 3.68 which is between the moderate level of difficulty and the high level of difficulty and is negatively skewed. This is the most challenging situation. The level of “no difficulty” was indicated by 5% (n=1). The level of low difficulty was indicated by 16% (n=3). The level of moderate difficulty was indicated by 11% (n=2). The level of high level of difficulty was indicated by 42% (n=8) and the level of extreme difficulty was indicated by 26% (n=5). As it can be seen from table No 2, the mode – the most frequent occurrence - is the high level of difficulty. As the skewness is between -1 and -0.5 the distribution is moderately skewed.

The student teachers who indicated moderate level of difficulty evoked the need to help the learners (“students need primary help to make them work faster”; “most of learners are not able to solve problems on their own”).

Those who indicated a high level of difficulty explained their choice by evoking the low understanding of students, the need to help/facilitate/manage students while solving problem, and not good to sit in a corner but better to move around to instigate students’ attention.

Those who indicated an extreme level of difficulty explained their choice by evoking mainly “not being able to control the class” and the “need to move around to help the learners”.

**Situation No. 07: Monitoring the work of each and every student or small group**

The seven situation of monitoring the work of each and every student or small group had an average score of 1.95 which between the level of “no difficulty and the low level of difficulty and is positively skewed. The level of “no difficulty” was indicated by 47% (n=9). The level of low difficulty was indicated by 21% (n=4). The level of moderate difficulty is indicated by 26% (n=5). The level of high level indicated by 5% (n=1) and the level of extreme difficulty was not indicated.

The student teachers who indicated a moderate level of difficulty evoked time consumption (“it takes long time to monitor”; “it is time consuming”) and big class size.

The one who indicated an extreme level of difficulty evoked the time consumption (“Time can not allow this strategy”).

**Situation No. 08: Allowing students or small groups present their answers to the given problems**

The eighth situation of allowing students of small group present their answers to the given problems had an average score of 2.16 which is between the low level of difficult and the moderate level of difficulty is positively skewed. The level of “no difficulty” was indicated by 42% (n=8). The level of low difficulty was indicated by 21% (n=4). The level of moderate difficulty was indicated by 21% (n=4). The level of high level indicated by 11% (n=2) and the level of extreme difficulty was indicated by 5% (n=1).

The student teachers who indicated a moderate level of difficulty evoked the big class size and time (“there is a big number of students with few time this does not run well”, “it takes much time”).

Those who indicated a high level of difficulty referred to curriculum and time (“the curriculum is very large”, “time does not permit”).

The one who indicated an extreme level of difficulty evoked time (there is little time, e.g. a lesson of 50min can contain everything like that”).

**Situation No. 09: Allowing students compare their answers**

The ninth situation of allowing students compare their answers had an average score of 2.26 which is between the low level of difficulty and moderate level of difficulty is positively skewed. The level of “no difficulty” was indicated by 47% (n=9). The level of low difficulty was indicated by 21% (n=4). The level of moderate difficulty was indicated by 5% (n=1). The level of high level indicated by 11% (n=2) and the level of extreme difficulty was indicated by 16% (n=3).

The student teachers who indicated a moderate level of difficulty evoked the time management in classroom.

Those who indicated a high level of difficulty evoked insufficient time (“because of time all students do not compare their answers”) and the other one referred to answers which are not correct (“… because some of them do mistakes ”).

Two of those who indicated an extreme level of difficulty referred to insufficient time ( ” we can not have time”, “Not simple because of limited time given to each lesson”). The third one referred to not being able to get the correct answer (“you can not know who work and that one who do not work correctly”).

**Situation No. 10: Allowing students synthetically summarise the learnt mathematical knowledge**

The tenth situation of allowing students synthetically summarise the learnt mathematical knowledge had an average score of 1.83 which is between the level of no difficulty and the low level of difficulty and is positively skewed. The level of “no difficulty” was indicated by 42% (n=8). The level of low difficulty was indicated by 26% (n=5). The level of moderate difficulty was indicated by 11% (n=2). The level of high level was indicated by 16% (n=3) and the level of extreme difficulty was indicated by 5% (n=1).

The student teachers who indicated a moderate level of difficulty evoked the inability of learners to summarize the learnt knowledge (“it is difficult to students to summarize the learnt lesson “, “this is possible at some extent with the help of evaluator”).

Those who indicated a high level of difficulty referred to inability of learners to do the summary (“because they forgot completely”, “because learner-centred approach is difficult, that is impossible”, not easy to summarise what you have not taken time to work upon yourself”).

The one who indicated an extreme level of difficulty evoked possible misinterpretation of the context (by summarising synthetically the learnt mathematical knowledge you can interpret in the context which is not true”).

**Situation No. 11: Correcting or completing the students’ summary of the learnt mathematical knowledge**

The eleventh situation of correcting or completing the students’ summary of the learnt mathematical knowledge had an average score of 1.83 which is between the level of no difficulty and the low level of difficulty and is positively skewed. The level of “no difficulty” was indicated by 47% (n=9). The level of low difficulty was indicated by 21% (n=4). The level of moderate difficulty was indicated by 21% (n=4). The level of high level indicated by 5% (n=1) and the level of extreme difficulty was not indicated.

One of the student teachers who indicated a moderate level of difficulty referred to inability of learners to summarise the learnt mathematical knowledge (“because many students do not know how to summarise the mathematical content”). Two of them evoked the easiness of correcting and completing the students’ summaries (“easy to make summary”, “It will be ok”); the fourth did not provide any explanation to his/her choice.

The one who indicated a high level of difficulty referred to time as he/she said “time conflicting”.

**Situation No. 12: Reflecting on the teaching and learning process and evaluating the lesson**

The twelfth situation of reflecting on the teaching and learning process and evaluating the lesson had an average score of 1.61 which is between the level of no difficulty and the level of low difficulty and is positively skewed. The level of “no difficulty” was indicated by 53% (n=10). The level of low difficulty was indicated by 26% (n=5). The level of moderate difficulty is indicated by 16% (n=3). The level of high level and the level of extreme difficulty were not indicated.

The student teachers who indicated a moderate level of difficulty evoked the usefulness of the reflection which is to help in improving the teaching and learning process (“because to reflect on T/L process and evaluation help us to improve our teaching and learning activities of next time”; “I have the capability to collect a diversity of feedback; analyse them for further improvement”).

**Situation No. 13: Planning for the next lesson basing on the findings of the previous reflections**

The thirteenth situation of planning for the next lesson basing on the findings of the previous reflection (situation No. 12) had an average score of 1.84 which is between the level of no difficulty and the low difficulty level and is positively skewed. The level of “no difficulty” was indicated by 47% (n=9). The level of low difficulty was indicated by 32% (n=6). The level of moderate difficulty was indicated by 11% (n=2). The level of high level indicated by 11% (n=2) and the level of extreme difficulty was not indicated.

The student teachers who indicated a moderate level of difficulty evoked the usefulness of the situation (“help in solving the problem”; “it will be ok”).

Those who indicated a high level of difficulty referred to the learners’ retained knowledge from the previous lesson (“because the learners sometimes did not remember the previous reflections”, because you may think that the previous lesson has been achieved as long as they [learners] do the exercises”).

# Implications and conclusions

From the findings presented above, it can be seen that the difficulties faced by the student teachers can originate from learners and from student teachers’ preparedness for the implementation of learner-centred approaches. From the side of learners, we can note the following: Lack of motivation, lack of interests, lack of textbooks, not understanding easily mathematical problems, low understanding of students, inability of learners to summarize, insufficient retained knowledge from previous lessons

Concerning the difficulties related student teachers’ preparedness, the following can be listed: lack of teaching aids, lack of time to finish the programme, lack of pre-prepared mathematical problems, need to help/facilitate/manage students while solving problem, “not good” to sit in a corner but better to move around to instigate students’ attention, time consumption and lack of time (This was frequent in situations Nos. 01, 05, 07, 08, 09, and 11).

As recommendations, student teachers should be trained and assisted on how to handle such difficulties by experienced mathematics teachers and mathematics teacher educators. Also School Leaders should be involved in providing textbooks to learners.

About the sixth situation of sitting in corner while waiting for students finish solving the mathematical, the student teachers that indicated having either moderate, high or extreme level of difficulty because of the need to help the learners, need to help/facilitate/manage students while solving problem, and the need to control the class.

However, this situation aims at creating an adidactic situation where the learners are interacting with the milieu without that interference of the teacher. Historical discoveries where there was no teacher to assist in learning situations can be referred to in order to bring student teachers to organise adidactic situation. The story of Newton and the apple is a very convincing situation.

Student teachers should be able to sit in a corner of the classroom and let the learners interact for some while with the milieu before they start moving around to monitor the work being done by the learners.

Lecturers at university level in charge of training mathematics teachers need to clarify further the importance and the creation of adidactic situations in the process of teaching and learning mathematics.

# Future research

Further research on how to deal with time management during the implementation of learner-centred approaches in teaching and learning mathematics should be undertaken.

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