Role of Mathematics Learning Development Centres in HEIs

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Abstract:

Background and Rationale: Student withdrawal and non-completion in institutions have been an issue of considerable concern. The lack of mathematical ability has been identified as a factor resulting to non-completion in higher institutions. Several students in higher education approach mathematics with a lot of anxiety. This has created the need to identify why students struggle with mathematics; and subsequently provide strategies and practical approaches to improving students’ perceptions of mathematics and their mathematical ability.

Objective and Methodology: The provision of mathematics support through learning and development services is a practical approach that is aimed at communicating mathematics and improving students’ mathematical thinking and ability. This study therefore investigates how students become involved in mathematics development services/centres and how such services impact on their learning experience. Subsequently, the study presents informative findings and results from a recently conducted survey of the perceptions of Aston University students on the mathematics learning development centre.

Findings and Outcomes: Mathematics Learning Development Centres have shown to be of significant and positive impact on students’ learning experience. The centre, through its services has enhanced the confidence levels of students as well as resulted in an improvement in the students’ grades.

Conclusion: It is essential for higher education institutions to implement strategies or steps to improve the teaching methods and strategies used in mathematics sessions, so as to subsequently reduce the problem of non-completion.

Keywords: Learning Development Centre, Mathematical-ability, Mathematics, Student

1.0 Introduction and Background

Mathematics does not simply develop an individual into becoming a teaching professional in the maths field or subject, but also develops the individual in other subject areas such as finance, accounting, logistics, business, engineering, and economics. Mathematics is a subject that has shown to have significant impacts on different matters and subject areas (Anonymous 2003; Smith 2004) such as interpretation of issues, map reading, weather forecasts, logical reasoning and decision making, critical thinking ability and problem solving skills. Notwithstanding, there is still the lack of interest in the study of mathematics (Fenwick-Sehl, Fioroni and Lovric 2009). The benefits associated with mathematics flag the need for students to develop and improve their mathematical skills and ability. Sadly, research show several students approach mathematics with a lot of anxiety (Furner and
Ramirez 2004; Mazzocco 2009), which limits their mathematical ability and results to non-completion in institutions (MacGillivray 2009).

Such anxiety with which students in higher education approach mathematics has created the need to identify why students struggle with mathematics (Nzekwe-Excel 2009); and subsequently provide strategies and practical approaches to improving students’ perceptions of mathematics and mathematical ability. Students’ perception of mathematics is developed and improved upon based on how they are being taught mathematics. This is to say that developing the mathematical ability of students entails addressing the teaching processes of mathematics. Thus, the methods and approaches for delivering mathematics sessions need to be investigated and improved upon.

Therefore, through this study, the provision of mathematics support through learning development services is investigated and explored as an approach for communicating mathematics and subsequently improving students’ mathematical ability. The reactions of students who struggle with or need an improvement in mathematics, which are discussed in subsequent sections of this study are shown in figure I. Section 2 discusses students’ beliefs and perceptions of mathematics. In addition, this section explores the need to review the approaches and techniques through which mathematics is communicated and taught. Subsequently, section 3 is devoted to a discussion on the significance of Mathematics Learning Development Centre. Here, the study presents and discusses the impact of the mathematics learning development centre on students’ progress and mathematical thinking ability through a recently conducted survey on Aston university students. Finally, sections 4 and 5 presents the conclusion and references used in this study respectively.
2.0 Why Do Students Struggle With Mathematics

2.1 Students’ Perceptions of Mathematics

The beliefs and perceptions of students with respect to mathematics influence and jeopardise their approach to learning mathematics (Lazim et al., 2004). Where such perceptions are negative, this creates worry and anxiety in students thereby minimising their interest towards developing and improving upon their mathematical thinking ability. Ashcraft and Faust
(1994, cited in Sheffield and Hunt 2007) define maths anxiety as “feelings of tension, apprehension, or even dread that interferes with the ordinary manipulation of number and the solving of mathematical problems”. According to Tobias (1993), mathematics anxiety could result in loss of self confidence. Subsequently, Lampert (1990, cited in Lazim *ibid.*) argues that incorrect perceptions about mathematics create reluctance in students in developing other potential subject areas such as information technology. Thus there is the need to create and/or re-create the right perceptions of mathematics in students through the utilisation of appropriate teaching methods and approaches.

2.2 Teaching Strategies and Approaches

The approaches and methods used in teaching and communicating mathematics help to either develop or discourage students’ interest and keenness in the subject. This is to say that in order to minimise students’ worries, struggles and anxiety with mathematics, it is necessary that mathematics is taught and learnt with fun. Mathematics support specialists and tutors need to provide mathematics sessions using more communicative style involving a practice-based approach. Involvement entails active communication between the student and tutor, and/or student and fellow students, during and after the mathematics class sessions. In view of this, Boaler and Greeno (2000) point out that an improvement or reform-oriented tutor would enhance a student’s mathematical knowledge through discussions. A study by Treichler (1967, cited in Crowest 1999) show that students learn 70% of what they discuss with people whose opinions they value; whereas they learn just 10% of what they read and 20% of what they hear.

Abbasi and Iqbal (2009) demonstrate how the use of interaction between the teacher and the students impacts on the students’ progression. The authors conclude by stating that mathematics teaching sessions could be made more interactive and interesting by having the tutors/teachers being more dedicated (better informed in the maths subject area), giving more logical reasoning/instances, and integrating technologies (maths software) in the teaching sessions. Furthermore, a study carried out by Boaler (2000) show that students who learnt mathematics traditionally using text books found it difficult to adapt to new/different situations, unlike their counterparts who were more engaged in interpreting, discussing and practising mathematics. Similarly, the study conducted by Tonkes *et al.* (2009) show that students prefer being involved during their maths lectures to the traditional style of copying notes.

The above findings and arguments on students’ maths perceptions and maths teaching approaches create an inspiration to further introduce and adopt strategies or steps on how to improve mathematics teaching sessions, facilitate student-involvement, and subsequently reduce the problem of non-completion. The provision of mathematics support through
learning development services is a practical approach that is aimed at communicating mathematics and improving students’ mathematical thinking and ability. Research shows that learning development services in mathematics have contributed to students’ progress and improvement (MacGillivray and Cuthbert 2003; Daley 2009).

3.0 Mathematics Learning Development Centre (MLDC)

A mathematics learning development centre (MLDC) is a unit that provides extra-curricular assistance in mathematics covering mostly all subject areas. For the purpose of this study, focus and emphasis would be placed on the MLDC in Aston University. Aston University is based in Birmingham, which is in the West Midlands region in United Kingdom. The MLDC in Aston University is made up of specialist staff who offer free maths support to all students from any subject area on a drop-in basis. The centre is aimed at helping students benefit from additional maths resources and tuition provided in their program of study. The key characteristics and benefits of the university’s MLDC include:

- Free, available and easily accessible
- Flexible, in terms of drop-in
- Provides interactive assistance on a one-one or group basis (as preferred by the students)
- Adopts a variety of approaches in solving mathematics problems
- Moves from generalisations to specifics

A total of 3415 students visited and used the MLDC for the academic year 2008/2009. The MLDC tutors covered a wide range of queries from the students (Aston University), some of which are Basic/fundamental mathematics, Calculus, Engineering mathematics, Mathematics methods and differential equations, Operations management, Statistics and probability, Vector algebra, Financial accounting, Business decision analysis, Quantitative techniques, Econometrics.

3.1 Survey Profile and Purpose of Study

The survey on the students’ usage of the Maths Learning Development Centre in Aston University was conducted in May 2009. The purpose of the survey was to identify students

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1 The pilot survey forms part of a wider investigation on students’ usage of the Learning Development Centre being undertaken as a project at Aston University, UK.
who use the Learning Development Centre (LDC), as well as the impact of the centre’s services on the students’ learning process. MLDC or maths centre is a subsidiary of the LDC.

3.2 Participants

Given that the survey was based on students’ perceptions and usage of the MLDC, the participants were students of Aston University. The students (respondents) represent a mixture of gender, subjects, year/ level of study, preferences/ interests, different backgrounds, and different age-groups. The data shown in table 1 represent the category of student respondents who were involved in the survey.

3.3 Method adopted for the study

Through the survey, an impact-focussed questionnaire was designed to seek information from the students. The questionnaire design was based on a review on the role and impact of learning development centre on the students’ learning. The questionnaire was distributed to all registered students in the 2008/2009 academic year (9663 in total) through online/ email correspondence. For the purpose of this study, only four of the questions asked during the survey are used. These four questions are the ones primarily channelled towards the maths centre. The questions are:

- How did you become involved in the Maths Support Centre?
- What appealed to you about using the Maths Support Centre?
- Please describe the Maths Support Centre in three to five words
- In what areas do you think the Maths Support Centre has contributed to your personal development?

3.4 Data Collection and Discussions

The distributed questionnaires, which were collected via email correspondence, resulted in 377 responses, indicating a 4% response rate from the total student population. However, the student attendance to the maths centre (3415) indicates a 35% attendance rate from the total student population for the 2008/ 2009 academic year (9663).
3.4.1 Students’ Responses

3.4.1.1 Question 1: Out of the 377 respondents, 227 students stated that they were aware of the maths centre while 150 students stated they were unaware of the centre. With respect to the actual respondents that have used maths centre, 196 students responded to this question where 55 students (28%) recorded they had used the maths centre, and 141 recorded they had not used the centre. The background data of the 55 respondents is shown in table I.

In responding to how and why they (students) got involved with the maths centre, more than seventy percent of the 55 students recorded that they became involved with the centre following the need and quest for help in the mathematical elements of their courses as well as to facilitate their understanding of certain mathematical processes/terms. Some of the respondents (over thirty-five percent) further stated that when they got stuck/ were struggling at some stage in their course, they needed a friendly assistance from a tutor, which the maths centre was able to provide.

Table I: Background Data of Respondents Using Maths Centre

<table>
<thead>
<tr>
<th>Gender</th>
<th>Status</th>
<th>School/ Faculty</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male = 21</td>
<td>Home (UK) = 51</td>
<td>BS = 11</td>
<td>Foundation year = 1</td>
</tr>
<tr>
<td>Female = 34</td>
<td>European = 2</td>
<td>EAS = 28</td>
<td>Year 1 = 15</td>
</tr>
<tr>
<td></td>
<td>International = 2</td>
<td>LHS = 14</td>
<td>Year 2 = 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IDS= 2</td>
<td>Year 3/ placement = 13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Masters level = 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Others = 2</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
</tbody>
</table>

BS = Business School; EAS = Engineering & Applied Sciences; LHS = Life & Health Sciences; IDS = Inter-Disciplinary Studies
3.4.1.2 **Question 2:** Though there was a wide range of responses/viewpoints with respect to what appealed to the students about using the maths centre, the recordings of the respondents indicate that the students regard the centre as being an integral and useful service for their learning experience. Some of the responses recorded by the students include accessibility/drop in, one-one/ ability to move at students’ pace, free service, usability/ease of use, extra help besides lecture sessions, availability, etc. Three notable responses to this question were ‘Getting help from tutors/lecturers in a way that can’t be taught through textbook/notes; ‘You can go on your own time and have one to one face time with the lecturers to help go over any difficulties’; and ‘The fact that I wouldn’t stand a chance of passing without it!’.

3.4.1.3 **Question 3:** Out of the 55 students that responded to using the maths centre, 51 of them answered this question. Specifically, 35 students recorded ‘helpful’ as one of the words used to describe the maths centre. This indicates that sixty-nine percent of the respondents consider the centre as being a ‘very helpful’ service in their learning process. In addition, several students (out of the 51 respondents) recorded ‘efficient/efficient’, ‘useful’, and ‘friendly’ in describing the maths centre. Figure II shows a pictorial representation of the four afore-mentioned keywords that were mostly recorded by the respondents.

![Figure II: Keywords used by Respondents to describe the MLDC](image)

Source: Daley (2009)
3.4.1.4 Question 4: With respect to how the maths centre contributed to the students’ personal development, there was a wide range of responses from the respondents who stated they had used the maths centre (43 out of the 55 students responded to this question). Particularly, the students noted that the maths centre has resulted in the development and improvement of their mathematical thinking ability. Some of the comments worth taking in consideration include:

- Reduced maths struggle (over 50% of the 55 respondents stated this)
- Decision making ability
- Increased confidence
- Flexibility in learning style and pace (up to 60% of the 55 respondents stated this)
- Improved grades/ pass level

Source: Adapted from Daley (2009)

4.0 Conclusion

This study highlights the significance of maths learning development centres using relevant arguments and findings. In doing this, the study emphasise that maths learning development centre positively impacts on students’ mathematical ability and grade levels. In particular, considering that the MLDC is a practical and active scheme, it does not just help to develop students’ mathematical skills but also re-models and contributes to addressing their negative experiences and perceptions about mathematics. This creates the need to encourage students to recognise and admit their inabilities and weaknesses in mathematics, and subsequently seek assistance from maths development centres within their institutions. Therefore, it is crucial that tutors, lecturers and students perceive mathematics development centres/ services as part of students’ learning process and not as an add-on or deficit-solving tool. It needs to be seen and adopted as a developmental initiative.

5.0 References


