

The Development of an Online Math Learning Resource and Support Center for ODL Learners

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Abstract

As an open and distance learning university and leading provider of flexible learning, Open University Malaysia (OUM) caters to its learners and strives to be learner-centered. There are continuous efforts to enrich the learning experiences of all its learners, whereby providing support to learners is one of them. OUM has been providing support in different capacities and in different areas, all with the aim of improving student retention.

There has been a continuing concern with the success rate of learners enrolled in math courses at OUM. There may be several contributing factors including lack of preparedness and lack of basic math skills. There is clearly a need for providing additional support in that area to help learners improve their math skills and be better prepared, and in turn help increase their chances to succeed in their early math courses at OUM. Being an ODL institution, providing support online seems practical and by doing so OUM can reach out to its learners wherever they are and provide help whenever needed. This paper highlights the development of an online math learning centre to provide such support for independent study to OUM learners.

Introduction

Mathematics is a challenging subject for many adult learners. The subject itself can be intimidating to the learners especially when they have always had a difficult time understanding math. Learners struggle with assigned math problems and they become easily frustrated and feel helpless and discouraged. The increased frustration results in resentment and the learners' anxiety towards the subject may heighten. When learners have experienced years of being unsuccessful in math, they lack confidence in their ability to do math. Adult learners need a lot of support in helping them improve and succeed in math.

Open University Malaysia (OUM) offers open entry and flexible mode of learning. Thus a majority of its learners are working adults and are non-traditional learners. OUM strives to be learner-centered and provides support to its learners in different capacities to help them succeed through their program of studies. One of the areas of concern is the success rate of learners enrolled in math courses at OUM, particularly in their first math course.

At OUM, Preparatory Mathematics is a course offered by the Faculty of Science and Technology. It is a 3-credit hour course that is offered for learners in the Bachelor of Mathematics and Management with Honours and the Bachelor of Mathematics and Information Technology with Honours programs. The course covers various topics in Beginning Algebra and Intermediate Algebra, as well as two topics from Introduction to Statistics. Although the topics seem relatively basic in nature, the work produced by learners in their midterm and final exams and the results of their exams indicate that learners are struggling and have difficulty with the topics covered in the course.

Several factors or a combination of factors could have contributed to the low scores. Among them could be lack of exam preparation, test anxiety, lack of motivation, lack of understanding of topics, lack of basic math skills, lack of time, lack of intervention and so on. Since a majority of the learners are adults, and most of them have not had to deal with math in a formal way for several years, factors such as lack of preparedness and/or lack of basic math skills could be the main reasons for the low performance on exams. The failure rate for the course has been considerably high.

When the learners enroll in the course, they are required to attend five two-hour face-to-face tutorial sessions during the semester. In addition, they have the option to participate in online discussions through OUM's myLMS discussion forums with the tutors and their peers. However, there is low participation in the forums and not everyone attends the tutorials due to the fact that attendance for the tutorials is not compulsory and participation in the online discussion forums contributes very minimal marks (5%) to the overall grade.

Based on the current situation, there is clearly a need for providing additional support to help learners improve their math skills and be better prepared, and in turn help increase their chances to succeed in their early math courses at OUM. Being an ODL institution, providing online support seems practical and by doing so OUM can reach out to its learners wherever they are and provide help whenever needed. The OUM Mathematics Resource Centre was developed with the sole purpose of providing the necessary resources for OUM learners to review or build up their basic skills in math and better prepare themselves for their math courses at OUM, and subsequently improve their chances for success. The following details the development process, resources, and services of the e-Resource Center.

Development of MRC

The development of the OUM Mathematics Resource Centre (MRC) is a project undertaken by the Senior Vice President's Office and began in March 2009. The MRC was initially designed based on characteristics and functions similar to that of a tutoring/learning center. Traditional and on-ground universities and colleges normally have their own tutoring centers which offer free tutoring and support services to learners, either on a walk-in basis or by appointment. Learners can get help from tutors, other than their course instructors, throughout the day when they are on campus. Being an ODL institution, OUM learners are not on campus and appear at the learning centres scattered throughout the country only at limited times throughout the semester. Since online learning is a component of the blended learning at OUM, the university already utilizes its own learning management system known as myLMS. It would then be practical to develop the online resource centre utilizing the same platform as myLMS. Learners logged on to myLMS can access the resource center from myLMS. The MRC is currently in the development stage and will be made available and accessible to the learners by August 2009.

Rationale

The following provide justifications on the establishment of the OUM Mathematics Resource Centre (MRC):

- Being learner-centered OUM is committed to providing support to its learners. The failure rate for learners enrolled in the early math course is more than 50%. Based on student work on assignments and exams, there is an indication that learners are struggling in math and they may be failing due to lack of basic math skills.
- The level of math for this Preparatory Mathematics course is higher than a basic mathematics course. OUM currently does not offer any developmental math course or remediation course that will help non-traditional learners prepare for this first math course in their program.
- In the current assessment practice for the course, the assignment is due after the mid-semester examinations. There is lack of monitoring of learners' progress during the weeks prior to the mid-semester exams and the assignment.
- Although tutors for the course are expected to be available for learners, they cannot be online all the time to assist learners who need help. Some tutors may not be able to respond to learners within reasonable time.
- The learners can meet with their tutors face-to-face for help during a two-hour tutorial session every two weeks. Since attendance is not compulsory, some learners do not show up for the tutorials. During these tutorials, tutors usually follow a lecture and discussion format. There is not much time for one-to-one sessions.

- Learners are not actively participating in the online discussion forums and seeking help from tutors. This could be attributed to the several factors including late response and feedback from tutors which in turn reflects poor online facilitation, low weightage on online participation, technical problems such as slow servers or downtime, no access to internet, online anxiety, and so on.

The MRC can serve as another alternative for learners to get help from tutors specially dedicated to the center. They can get help through synchronous or asynchronous modes. The resources available focus on topics in Basic Mathematics and can be useful for review on basic math skills.

Functions of the MRC

The MRC will function mainly as a learning and resource center for OUM learners who need help in basic Math and/or would like to review early math topics. A variety of resources will be made available for the learners. The centre will also benefit instructors by offering useful resources for teaching math.

The MRC also plans to offer free online tutoring service to registered OUM learners and learners will be able to get live help from available online tutors. The service will be made available initially for 4 hours during the day time and 4 hours in the evening. Eventually the service will be made available 24 hours. The service will provide a convenient option for learners who encounter difficulties and need immediate help. There will also be a forum area for learners to post questions and available tutors will respond to their questions. It is not designed as a substitute for the online class forum, but will serve as an alternative for learners who are unable to get help from their course tutors/facilitators, especially during odd hours. Figure 1 shows the Home page for the MRC, which is currently still under development.



Figure 1 MRC Home Page

Types of Resources

The MRC will house a variety of resources for learners' use. Resources will include supplemental notes, supplemental practice exercises (PDF), interactive/multimedia tutorials, interactive practice problems, pencasts, and audio/video tutorials. There are also links to useful math websites with external resources.

The internal resources are developed in-house and utilize the concept of learning objects. Learning objects can be digital or non-digital. With careful design, they can be effective and meaningful learning materials. The challenge is to design and create quality learning objects that provide meaningful learning to the users. Some of the criteria to be considered when developing the content include clarity, stimulating presentation, structured and organized information, suitable and proper approach, engaging, ease of use and motivating. Most importantly they are designed and developed based on learning outcomes.

The development of resources will be an ongoing effort and resources will be uploaded as they become ready. A database will be kept on all the different types of resources available at the MRC.

Please fill in the information required and click Submit button.

Keywords :

Topic : All

Type : Please Select...

[0-9](#) [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)

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No.	Resources	Description	Date
1.	Ratio and Proportion	Interactive Activity: Practice with Ratio and Proportion	2009-07-01
2.	Intro to Algebra: Translating English to Algebra	Interactive: Practice with translation	2009-06-17
3.	Solving Applied Problems Involving Simultaneous Equations	Interactive: Practice with Simultaneous Equations	2009-06-17
4.	Exponents	Interactive Activity: Notes and Practices on Rules of Exponents	2009-06-09
5.	Ratio and Proportion	Interactive: Notes and Examples	2009-06-03
6.	Percents: Changing Between Percents, Decimals, and Fractions	Interactive: Notes and Examples	2009-06-02
7.	Intro to Algebra: Distributive Property	Interactive: Practice with the Distributive Property	2009-05-29
8.	Signed Numbers: Scientific Notation	Printable Worksheet: Practice drill with answer key	2009-05-28
9.	Solving Applied Problems Involving Fractions	Interactive: Application problem example involving Fractions	2009-05-27
10.	Exponents: Practice Rules	Interactive Activity: Practice Rules of Exponents	2009-05-25

Figure 2 Resources List Page

Figure 2 above shows a screenshot of the Resources List Page. The learner can browse for a resource, or do a search for a resource, either by topic, by keyword, or by type of resource.

Sample Resources

Practice Exercises with Answer Keys

There are also short self-practice exercises in PDF format. Users can download these exercises and work on the problems offline. Answer keys are provided. Learners can check their answers and if they

have questions they can return to the centre and post their question in the forum area or request help from a live tutor.

Interactive Practice Exercise

Figure 3a, 3b and Figure 4 below show samples of interactive practice exercise. The practice items are given in multiple choice format. When the learner selects an answer the feedback window pops up. Substantive feedback is provided rather than a simple ‘Correct’ or ‘Incorrect’ response. Where possible, explanations for the errors are pointed out. Feedback is provided on the answer level as opposed to the question level.

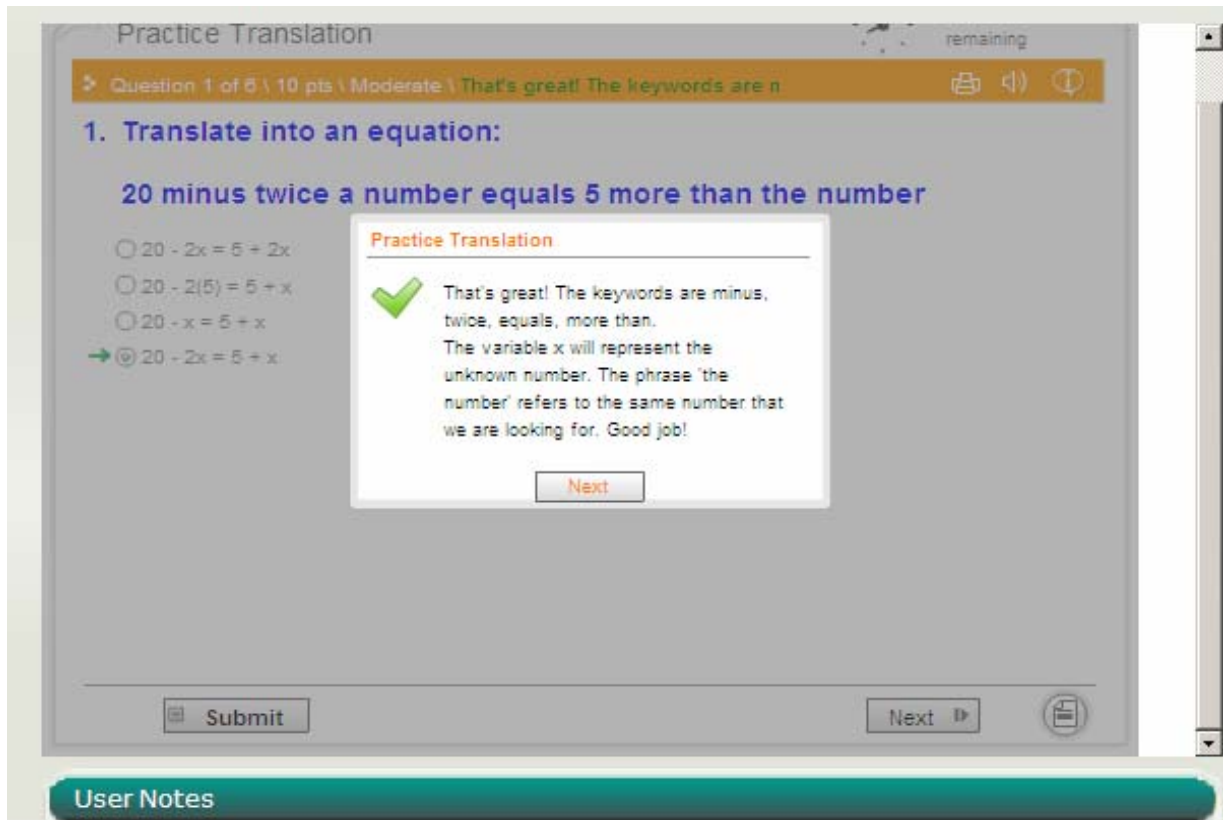


Figure 3a Sample Interactive Practice Exercise

Practice Translation remaining

Question 2 of 6 | 10 pts | Moderate | That is not correct. The word 'of'

2. Translate:

88 is what percent of 70?

$m \cdot 70 = 88$
 $m = 70 \cdot 0.88$
 $m \cdot 88 = 70$
 $m = 88 \cdot .07$

Practice Translation

✖ That is not correct. The word 'of' represents multiplication. 'what percent' can be represented by the unknown variable. And 'is' will be replaced by '='. So we should have $88 = m \cdot 70$. Or $m \cdot 70 = 88$.

[Next](#)

User Notes

Figure 3b Sample Interactive Practice Exercise

[Add Note](#) | [Post a Question](#)

PRACTICE: POWER RULE

Use the Power Rule to simplify the given expression. Click on your choice for an answer.

$(3xy)^2 = ?$

$9x^2y^2$

$6x^2y^2$

$3xy^2$

iSpring 5 / 13 00:25 / 01:05

User Notes

[Add Note](#) | [Post a Question](#)

PRACTICE: POWER RULE

Use the Power Rule to simplify the given expression. Click on your choice for an answer.

$$(3xy)^2 = ?$$

$9x^2y^2$

Not quite. It looks like you know how to apply the Power Rule -when factors are raised to the same power, each factor gets the power. But you miscalculated the coefficient 3^2 . It is equal to 9 and not equal to 6. Your answer should be $9x^2y^2$.

NEXT

iSpring 6 / 13 00:30 / 01:05

User Notes

Figure 4 Interactive Practice Exercise with Feedback

Pencasts

Figure 5 below shows a sample pencast which can be viewed full screen. Pencasts are created using the Smartpen, a useful tool from Livescribe. With the Smartpen, instant recordings of the sound as well as the written notes can be done. Learners can view the step-by-step process of solving a problem and listen to the explanation at the same time. Learners can also jump to different parts of the notes.

Solving Basic Linear Equation
brought to you by Livescribe

Solving Basic Linear Equations .

(a) $2x + 5 = 13$.

Solve for x .
objective .
Find a value for x
that works for the equation .

$2x + 5 = 13$
↓
Isolate LHS = RHS

$2x + 5 + (-5) = 13 + (-5)$
↓
 $2x = 8$

$\frac{2x}{2} = \frac{8}{2}$
↓
 $x = 4$

x is the solution to the equation .

Check Use $x = 4$ substitute into the original equation
Want to check if $2(4) + 5 \stackrel{?}{=} 13$.

$2(4) + 5 \stackrel{?}{=} 13$
↓
 $8 + 5 \stackrel{?}{=} 13$
↓
 $13 = 13$ ✓ $\therefore x = 4$ ✓

Figure 5 Sample Pencast With Audio

Interactive Activities

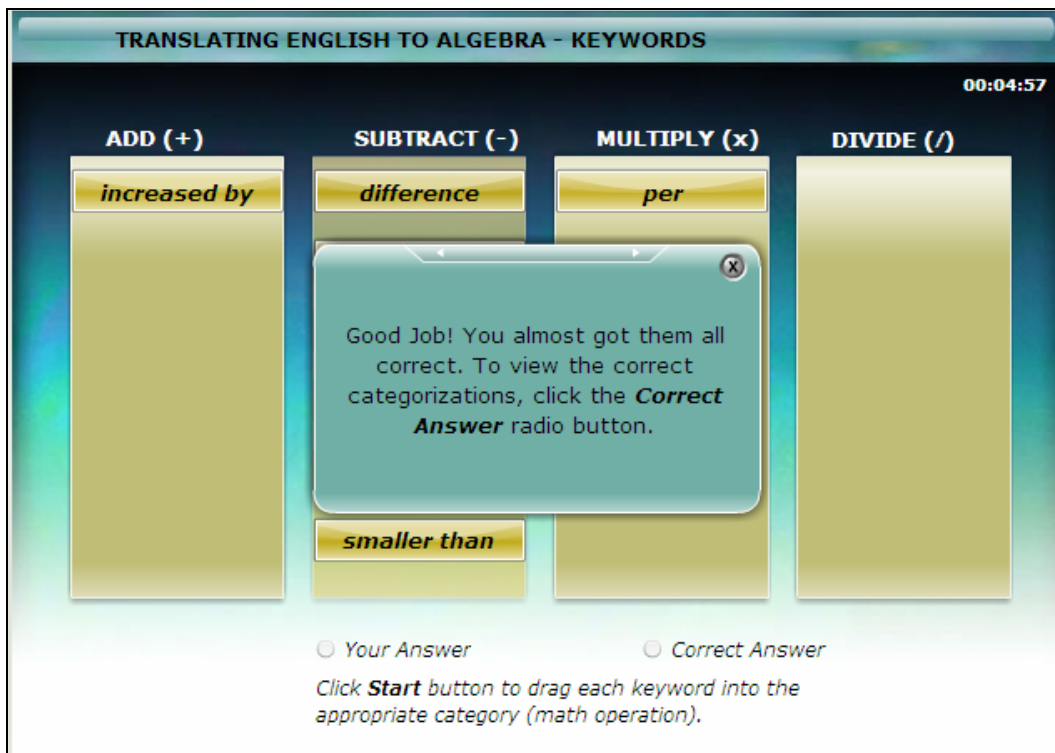


Figure 6a Sample Interactive Activity – Categorizing

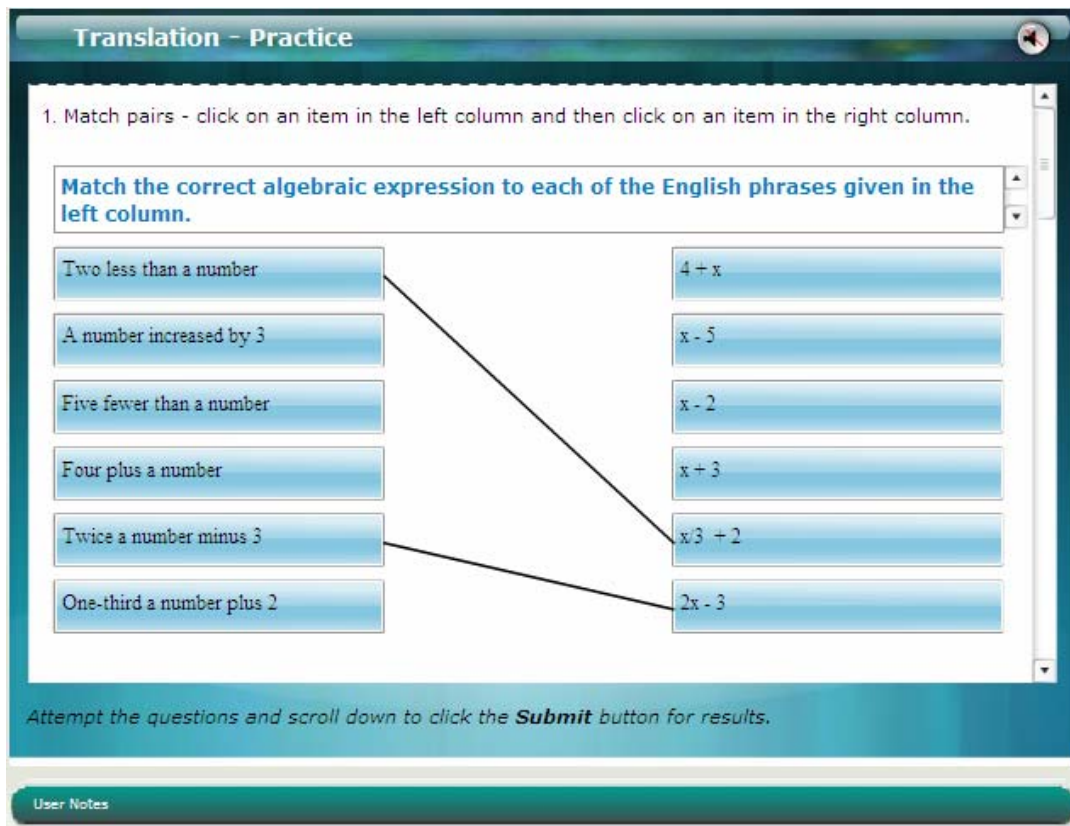


Figure 6b Sample Interactive Activity – Matching

There are also learning objects that incorporate interactive activities. Figure 6a shows an example of an activity that requires learners to sort English words and classify them by their associated operations. This exercise was meant to help learners identify important keywords that are often used in application problems and know which mathematical operation the keywords are associated with. Figure 6b shows another example where learners have to match the phrases with the proper algebraic translations.

Supplemental Notes

Some of the resources provide supplemental notes for learners. Figure 7a shows a sample of notes prepared for multiplying polynomials, specifically binomials. They review the FOIL method and after that they will be able to see worked examples.

Figure 7b shows sample notes on solving equations with fractions. Learners have to click the mouse to proceed with each step of the multiplication process. They will be able to see detailed explanations. They can also click on the highlighted terms to get brief explanations of the terms.

[Add Note](#) | [Post a Question](#)

MULTIPLYING TWO BINOMIALS

FOIL Method

Click on each of the terms below to know how to use FOIL Method.

Question: Multiply $(a + b)(c + d)$

First Terms ▶ $(a)(c) = ac$

Outer Terms ▶ $(a)(d) = ad$

Inner Terms ▶ $(b)(c) = bc$

Last Terms

$(a + b)(c + d)$

Back
Next

User Notes

Figure 7a Sample Notes on Multiplying Binomials

[Add Note](#) | [Post a Question](#)

SOLVING EQUATIONS WITH FRACTIONS

Let us look at an example of equation with fractions. How do you solve the following equation?

$$\frac{3}{8}x - \frac{3}{2} = \frac{3}{4}x$$

Click on each of the steps to know how to solve equations with fractions.

Steps to solve the equation:

1. Transform equation to an equivalent equation by multiplying equation by the **LCD**. (Here, the LCD for the denominators 8, 2 and 4 is 8.)

$$8\left(\frac{3}{8}x - \frac{3}{2}\right) = 8\left(\frac{3}{4}x\right)$$
2. Use the **Distributive Property**.

$$\left(\frac{8}{1}\right)\left(\frac{3}{8}\right)x - \left(\frac{8}{1}\right)\left(\frac{3}{2}\right) = \left(\frac{8}{1}\right)\left(\frac{3}{4}\right)x$$

$$(1)(3)x - (4)(3) = (2)(3)x$$
3. Simplify.

The Distributive Property says that if a, b, and c are real numbers, then $a(b + c) = ab + ac$. Both b and c share a on the left side of the equation; on the right side of the equation the a has been distributed to b and c.

User Notes

Figure 7b Sample Notes on Solving Equations with Fractions

Glossary

A glossary of math terms was also created for the MRC (shown in Figure 9 below). Terms and definitions can be added to the glossary as needed. The glossary is accessible at any time while browsing or viewing resources available.

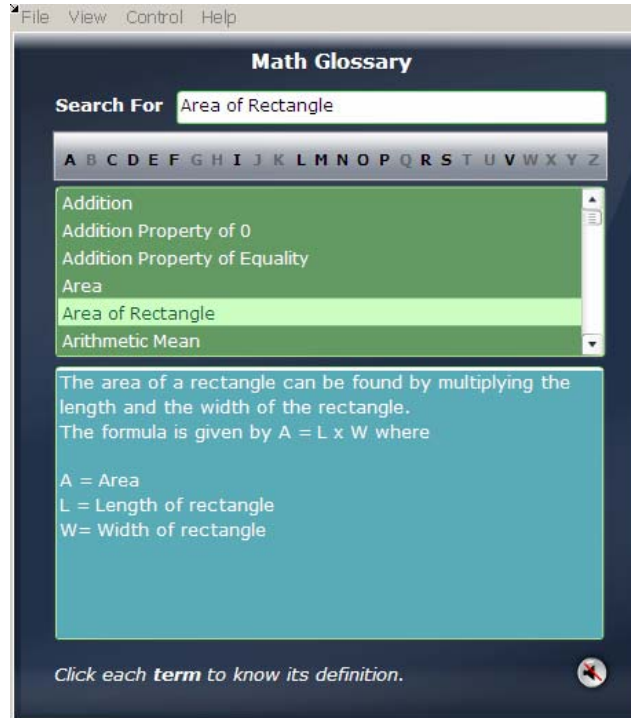


Figure 9 Glossary

The Way Forward

Continuous Development of Learning Materials/Learning Objects

The MRC must continue to build its resources and as such the development of learning materials or learning objects will remain an ongoing project. It will be a challenge to produce as many helpful and meaningful resources for learners who use the MRC. There are many topics to be covered. Although many learning materials have been developed and are now available, the development process is relatively slow given limited help and limited staff. An even bigger challenge and more important task is to develop quality learning materials and learning objects that are engaging and will benefit the learners. The development of each learning material is time consuming and a lot of attention must be given to their design.

Online surveys will be conducted to gather feedback from users on the resources and the MRC in general. This will also help with the continuous improvement of the learning resources developed for the MRC.

Announcements

The Mathematics Resource Centre must be made known to learners, faculty and the OUM community in general. Announcements about the MRC and its functions will be made through OUM's myLMS as well as in OUM's publications, namely OUM Today, Learner Connexions and Tutor Connexions (TCX).

Continuous Support

It is the aim of the MRC to provide student support in learning math. Being online, the MRC will be available to learners around the clock. In addition, the centre will provide free online tutoring services to registered OUM learners, initially for limited hours, and eventually 24 hours.

Linking to Other Resource Centers

The MRC should be linked to other current mathematics resource centres that are available online. This will allow users to become aware of and be able to view and access readily available resources from other centres.

Conclusion

The MRC is being developed with the purpose of providing additional support to learners in the area of mathematics, particularly in basic and lower level math. The support will be given through the availability of learning resources that are engaging and of quality. In addition learners will be able to get live tutoring help through the online tutoring service. The new MRC is another innovation at OUM which focuses on the learners in providing online support at their conveniences and more importantly, when they are in need. This is one of OUM's continuous effort as a distance learning provider in supporting lifelong learning.

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