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An Innovative Approach to Improve Skills of Students in Qatar University Spending in Virtual Class through Learning Management System

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***Abstract*—**In this study, students' learning has been investigated and satisfaction in one of the course offered at Qatar University Foundation Program. Innovative teaching has been implied methodology that emphasizes on enhancing students' thinking skills, decision making, and problem solving skills. Some interesting results were found which could be used to further improvement of the teaching methodology. In Fall 2012 in Foundation Program Math department at Qatar University has started implementing new ways of teaching Math by introducing MyMathLab (MML) as an innovative interactive tool in addition of the use Blackboard to support standard teaching such as Discussion board in Virtual class to engage students outside of classroom and to enhance independent, active learning that promote students' critical thinking skills, decision making, and problem solving skills through the learning process.

***Keywords*—**Blackboard, MyMathLab, study plan, discussion board, critical thinking, active and independent learning, problem solving.

I. Introduction

DIFFERENT tools are being used to manage and deliver learning material in school to enforce the quality teaching through different Learning Management System. This method of delivery produces technology-based LMS (Learning Management System) and CMS (Content Management System) systems which are commonly used in the eLearning environment to create better and pleasant interactive and innovative teaching. In Foundation Program, Math and Computer Department at Qatar University have used Blackboard and MML (MyMathLab) a Web-based Learning Management System to enhance students' critical thinking skills, decision making, and problem solving skills. These systems provide interactive innovative teaching methods in a different ways to learn and understand the concepts of each introduced topic and information besides a regular class lecture. Moreover, it allows customizing lecture items in a personalized way. It facilitates in organizing all teaching tools [1] to create a pleasurable environment in the classroom.

We have organized and integrated our teaching resources such as online course material, homework, practice old tests, videos projects, clicker Questions and student views examples in MML to motivate learners to engage students outside of classroom to promote independent learning, critical thinking skills [6], decision making, and problem solving skills. Students become more engage, enthusiastic and independent learners.

In first stage, we used the course content of Pre-calculus course to develop a suitable course syllabus that answers the following fundamental questions:

- What are the minimum required skills and knowledge that student must gain from the course before entering to next higher level math course or entering other related math course where student need those skills and knowledge for that course
- Will our method of delivery lecture suit all type of students?
- Are we providing sufficient understanding of course material to improve critical thinking, decision making, and problem solving?
- Are we getting the proper feedback, response and comments from the student regarding all aspects of the course to improve the content?
- Are the contents interactive, innovative, and suitable to all students?
- What are the measures need to assess student on learning outcomes that satisfy for the course performance?

Based on these questions, we design the course syllabus that include all the answers to the stated of the questions into web based the course material that enrich the learning process of delivering the course material that students can access and interact with at anytime and anywhere whenever they are require to do so. Once a student is enrolled in any of Math courses at Foundation Program at Qatar University, automatically the student have an access to all course materials via LMS and this can always be controlled and monitored by the faculty.

The purpose of use of LMS and MML is to enhance learning and motivate students to engage outside of the classroom in the learning process so that they become independent learners and they improve the learning ability skills that will make them autonomous problem solvers. Active engagement is linked to increased motivation to learn, which can translate into a greater likelihood of meeting learning outcomes [4], [5]. We have implemented and integrated technology in all Math courses at Foundation Program Math department at Qatar University. Generally, all materials are accessible to students electronically in advance,

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in addition, all explained lecture notes are also posted to them, they can access to it at anytime and anywhere. We use the on-line assignments focusses on concept of each learning objective of course material are used to enhance traditional teaching methods, where face-to-face and online instructions intersect. We have designed menu bar in Fig. 1 "Description of Menu bar in Blackboard for Computer Course" so that students can easily interact on this site. Its items are well-defined and are always discussed in the classroom.

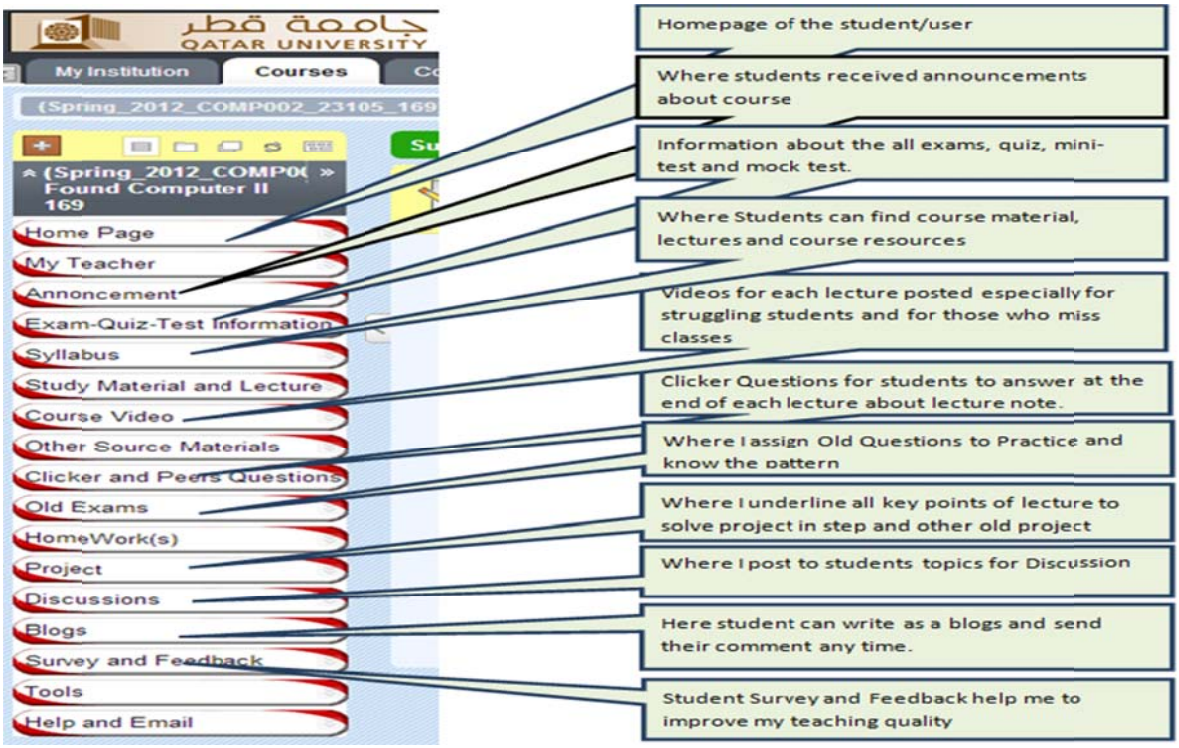


Fig. 1 Description of menu bar in Blackboard for Computer course

We have designed the menu so that student feels more interactive and can easily play around the content. One of the most interactive items here are Discussions Board Fig. 2 "Description of Menu bar in Blackboard for Math Course" and Blogs. Based on the need of delivery to the students we keep items in the discussion board or blogs. If we want to communicate or discuss with students about a topic, we utilize a discussion board. When we want a ready material or correct answer to communicate with students, we use blogs. This important feature of Discussion Board enables the students to engage in shared reflections as they respond to each other's postings like live charting on the particular topics. Students are provided with a series of small topic and questions to design and stimulate their critical thinking, decisions making and problem solving. The designed questions for each section are assigned at appropriate times throughout the course to engage students on focusing on key important topics of each lecture. Students are required to answer the questions in the discussion board using their own wording. They give their own examples to rationalize their response.

In Fig. 3 we highlighted the designed tools in (MML) which are an online interactive and educational system. It covers all the course aspect in addition to posted class notes for students. It is designed mainly for learners who seek more opportunity for practice, immediate feedback, and automated grading. It was developed by Pearson, a textbook publishing company. It is claimed by the company that since it was released, it has been used by 9 million students at 1,900 colleges in the United States. According to a Pearson survey, 80% of students who used this tool have reported that MML has helped them to succeed [5].

II. Steps to Improve Critical Thinking, Decision Making and Problem Solving

There are seven steps of Critical Thinking, Decision Making and Problem Solving required building a good thinker.

Step 1 Knowledge: Student must gain and apply from basic learning of introduced topics, issues, and concepts of keys learning objective.

Step 2 Comprehension: Comprehension means understanding the material while reading or listening [3].

Step 3 Application: When a leaner comprehends, they must be able to utilize the learning in the actual problem of application.

Step 4 Analysis: When a problem is large then we use this step of analysis.

Step 5 Synthesis: Synthesis means the small analyzed task mixed with the other information to form original new task and new look of the assignment.

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Step 6 Test: Test means when they face a new problem and are able to solve.

Step 7 Evaluation: Evaluation comes into the depiction when a learner understood and analyzed concept clearly.

We design questions in a way to improve their Critical Thinking such as:

- Develop and Analyze evidence to maintain circumstances
- Discuss topics and predict the consequences of events
- Develop and construct relationships of events
- Extend and apply knowledge to the events
- Justify and explain generalizations

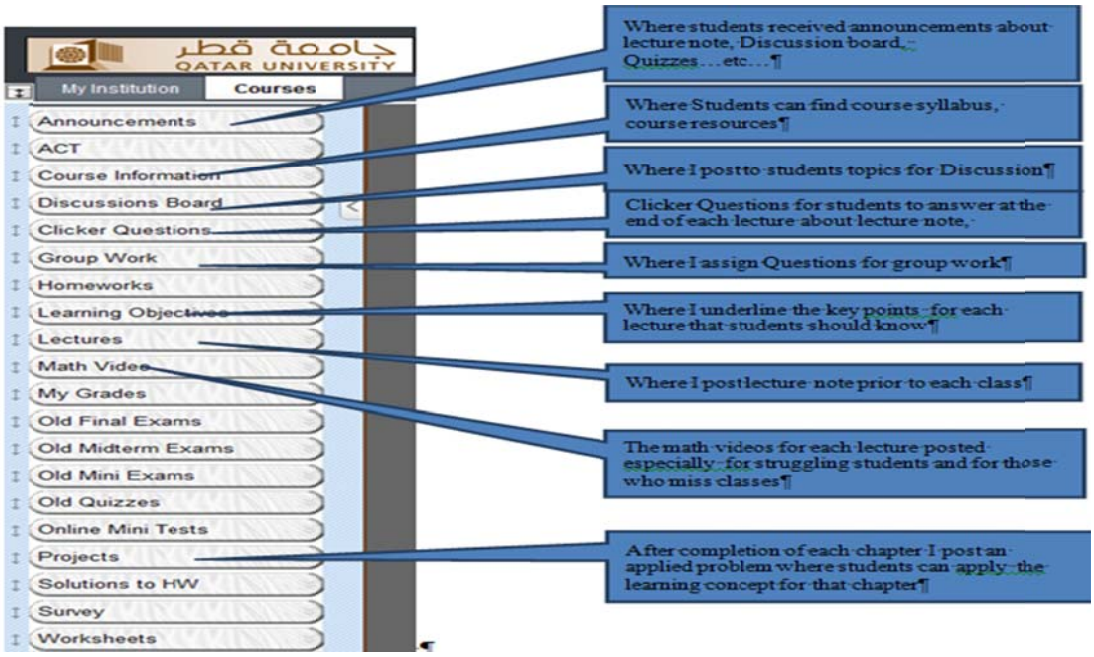


Fig. 2 Description of menu bar in Blackboard for Math course

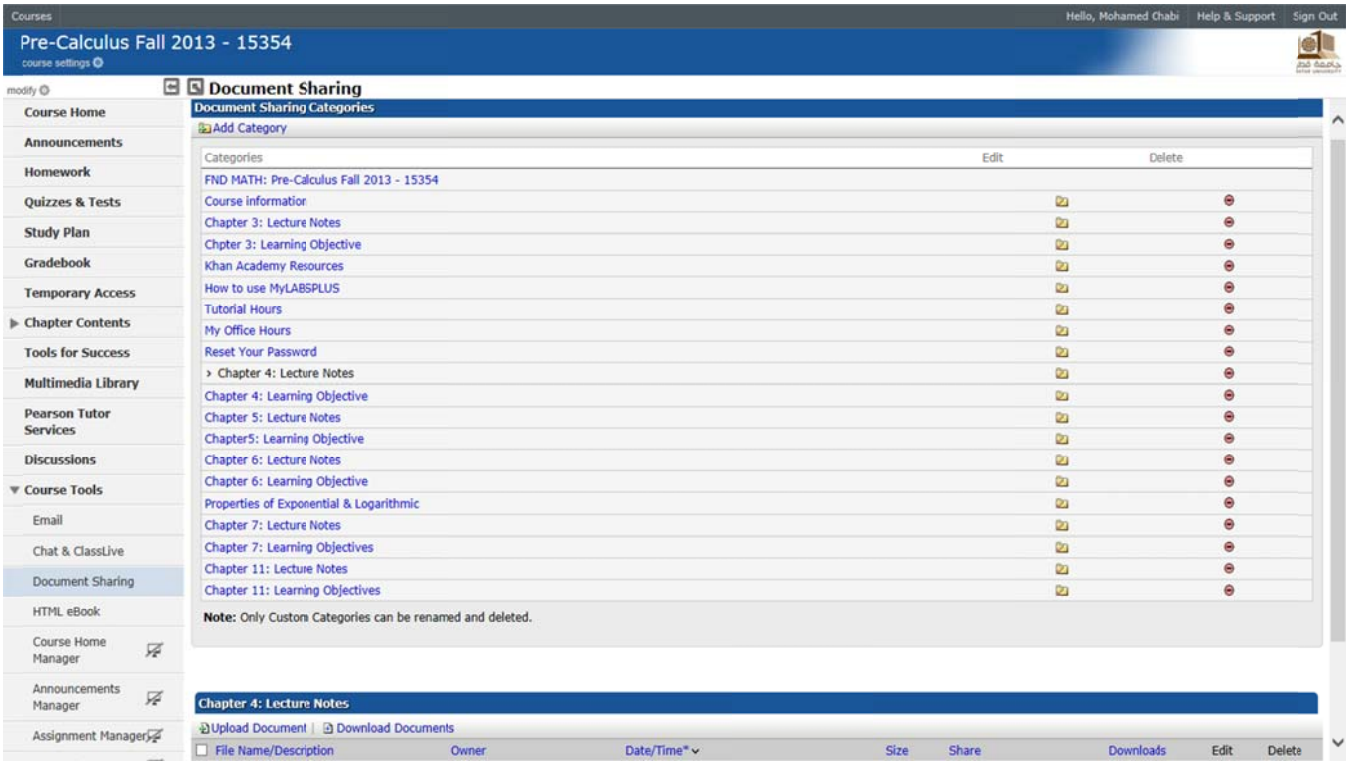


Fig. 3 Document sharing in MML Plus for a Math Course new picture

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III. Virtual Class

One of the most benefits to students using My Labs Plus is the Study Plan. Study plan is designed for students to improve their skills wherever they have difficulties in homework, Quiz or Test. After completing each assigned problems, My Labs Plus will generate questions that focuses on each point from the learning objectives in the study plan. In our study we used the coefficient of correlation r to determine whether the is a correlation between effective use of the study plan and a strong student's performance. We computer r = 0.94 which indicated that there was there was a strong correlations between completing the required questions in the study plan and a good student's performance in the course. Similar study was conducted in Summer 2012 for a smaller sample and we found r = 0.92 which confirmed the beneficially of the effective use of the Study Plan on learners. Table I shows the amount of time that student spent outside of class time.

TABLE I
Time Spent Outside of Classroom on Use of Study Plan

Total Hours Spent on Study Plan - Pre-Calculus				
	14W-F12-Female	14W-F12-Male	9W-S12-Female	9W-S12-Male
Max	86.7	74.1	116.75	73.87
Min	0.0	0.0	0.00	0.00
Median	11.6	4.5	13.03	7.93
Average	17.2	8.6	18.77	12.09
Stdev	5.2	2.9	19.34	13.29
Total	4056.1	1266.3	3359.84	1293.62
Enrolment	241	148	179	107

Table I shows that many students have spent several hours outside class time in their Study Plan. The maximum number of hours a female student had spent in study plan was 116.75 hours and for male was 74.1 hours. This innovative method establishes excellent learning tools and study momentum that allow students to share and discuss information easily with their classmates and the teacher and it gave them new opportunities to enhance their learning skills.

Note: 14W-F12 represents 14 regular week Pre-Calculus course in Fall 2012. 9W-S12 represents a 9 intensive weeks Pre-Calculus course in Summer 2012.

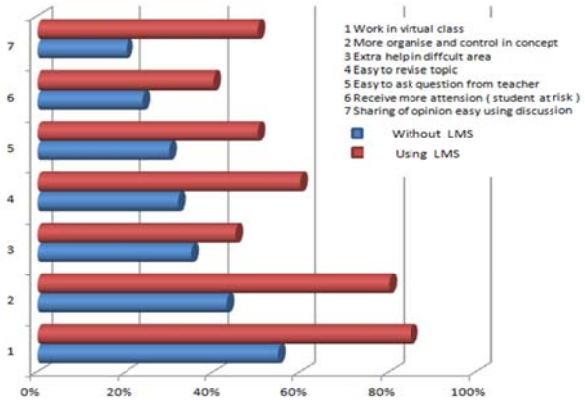


Fig. 4 Learner feedback spending to use LMS

For students' opinion on the innovative method of teaching, we conducted a survey with the students and asked seven questions from those who were using LMS and from those who were not using LMS. Collected feedback data presented in Fig. 4 "Learner feedback to use LMS". We find those students who have spent more time outside classroom means virtual class for learning, revision, and discussion have better skills development. In addition, students feel that much more comfortable with the teacher to ask and discuss their own focused problem. When a teacher realizes that a particular student is at risk means the students who are at the border or below the border needs immediate attention and so their more interactive participation can improve their skills. Finally, we found students are more comfortable in sharing their opinions and concepts with other students through the discussion board facility. We realized that students have different concepts during lecture and they are demanding to teaching style in the classroom because the current generation has more perception and thinking toward a technological context and they can gather animated information very fast. Therefore, we must change our style of classroom teaching using SMART interactive whiteboards, more animated video creative tools, similar videos of topics with more examples, Web 2.0 tools, and other such available options. It is also a challenge to create and maintain interest in all these classrooms.

In the current scenario, the learning technology is changing at an exponential rate and the current generation is more innovative to learn with this method of teaching and the above chart shows that students work more outside the class room or at home and these kinds of quality learning environments are required so that students will globally connect to know the latest updated materials and examples.

In the MyMathLab Study Plan, section students have several good options to improve their knowledge, clarify any confusion, and improve their skills independently. When a learner is facing problem to solve a question they can ask the system to "Help Me Solve This" or "View an Example" Moreover, they can watch the video of that related topic and they can scroll through some textbook material and examples. If they still face problems, they can send an email to their teacher for help or they can print the question or problem and can ask with others to understand and to solve. The screen shot shown in the Fig. 5 "Study Plan Complete Assistance"

We always encourage student to get involved in the participation either in the class or from their home through discussion board. We found the facts those students who are involve in participation in the virtual class to discuss and share their thought have better skill which reflect in their result.

Fig. 6 shows "Skill improvement who involved in VCD" students who scored very poorly in ACCUPLACER, and failed Math 4 "the old name for Pre-Calculus course" had improved their scored and this reflect on the effectiveness of our new methodology of teaching that involves VCD (Virtual Classroom Discussion) .There are some students who received a letter F in Math 4 got an B+ and A's in Pre-Calculus and this is an indication of huge improvement that will have a definitely a positive impact on learners.



Fig. 5 Study plan complete assistance in MML

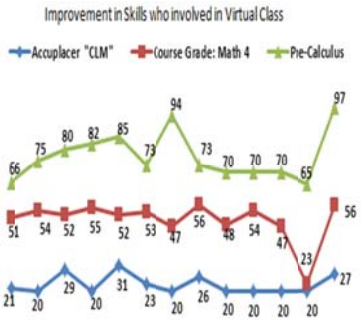


Fig. 6 Skill improvement of who involved in VCD

Reasons and the benefits of virtual classroom discussions (VCD):

- Flexibility in learning time
- Efficient learning
- Location is not a barrier for any type of learner.
- Especially ladies in the gulf area are free to discuss without reaching to particular classroom location.
- Actively involved in learning action and they can see all other member work to improve their own work and can add their ideas though discussion board.
- Learners are force to give feedback if they are in any process of activity.

IV. Techniques to Boost Skills

We adopted several techniques to improve the concepts, skills, and thinking of our students. In addition, we tested knowledge and learning after this technique and find improvement. We all suggest that our students take responsibility in performing the activities,, participating in full, and sharing their knowledge with the class using the Blackboard site. This, ultimately, will improve their skills and enhance their learning. Because, when they take the responsibility and try to attempt the tasks the chances of learning are higher through trial and error. They will also learn through mistakes and will be able to not to repeat their mistakes again. Participating in discussions can introduce the learners to other possible or alternative methods of solving the same problems they are working on. Finally, when students sharing ideas on the blogs, they can find a greater benefit to investigate new suggestions and they thought to improve further.

A. Utilization of Peer Instruction and Clicker Questions to Strengthen Concept

Peer instruction is a popular technique in innovative teaching and cooperative learning environment.

B. Utilization of Lecture Resources to Link with Interrelated Topics to Improve Learning Abilities

We provide lecture resources prior to the lecture time so that students can go through this to link with other topics of lectures and when they come to lecture time we provide the list of links and connections with the other topics and lectures so that students can match with their answers.

C. Utilization of Animation Repeatedly to Understand in-Depth to Enhance Knowledge

Computer animation techniques can help to increase knowledge and concept. Animation also assists to visualize the results obtained from the simulation.

D. Utilization of E-Assessment to Enhance Erudition and Thinking

When information technology is used in testing, it is known as an online test. E-assessment is very useful to assess cognitive and practical abilities.

Advantages of E-learning and E-assessment

- Reduce long term costs
- Provide immediate feedback to student know their grade.
- Number of repetition can be set to more practicing the same type of questions.
- Provide feedback to solve homework if answer is wrong.
- Provide flexibility in location-wise and time-wise.
- Improve reliability and impartiality

E. Utilization of Real Data in Project Development to Develop and Improve Problem Solving Skills.

We provide the students with the broader objectives of the project description and ask them to use the real data with slight changes to main integrity so that our main purpose to enhance learning and problem solving concepts will maintain.

V. Problem Faced to Improve Critical Thinking Using Challenging Question

Critical thinking requires students to act serious and be regular because we have to teach the concepts step by step and then a complete block of knowledge could be build. We faced problems in the following aspects:

- *Irregularity in Lecture Hour*: Some students get absent without any proper reason and they provide variety of excuses. This makes weak foundation of the learning and students gradually lose their interest.

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- *Gadget Use:* Nowadays, so many devices are available. This makes students busy in activities other than learning. Sometimes students are busy with mobile in sending SMS, chatting on Facebook or Twitter, or just replying to their emails. This makes class activity slow and teachers are unable to finish their lecture on time. Actually, this depends upon the teacher to provide more interactive material, motivate students during lectures, and drag their concentration back to lecture.
- *Unacceptable Behavior:* In few cases, we face behavior cross the limit because a teacher wants to stop them to use mobile and any unnecessary activity.
- *Social Issue and Community Gap:* Sometimes students do not want to interact with other students and reasons are beyond explanation in this research.
- *Lack of Background Knowledge:* When a student in lower level is not serious and just able to manage to clear paper then their knowledge is limited and sometimes when students are not regular in the class they face problems in understanding the advanced topics losing their interests being unable to complete tasks on time.

But an experienced teacher can minimize the above problem with their earlier experience [2].

VI. Results Analysis

In Fig. 7 shows how a student's performance is in homework, quizzes, tests (Mid exam and Final exam), and study plan. The results can be monitored through MML to follow up with student' progress through the course and an immediate intervention can be taken in case of a student was struggling.

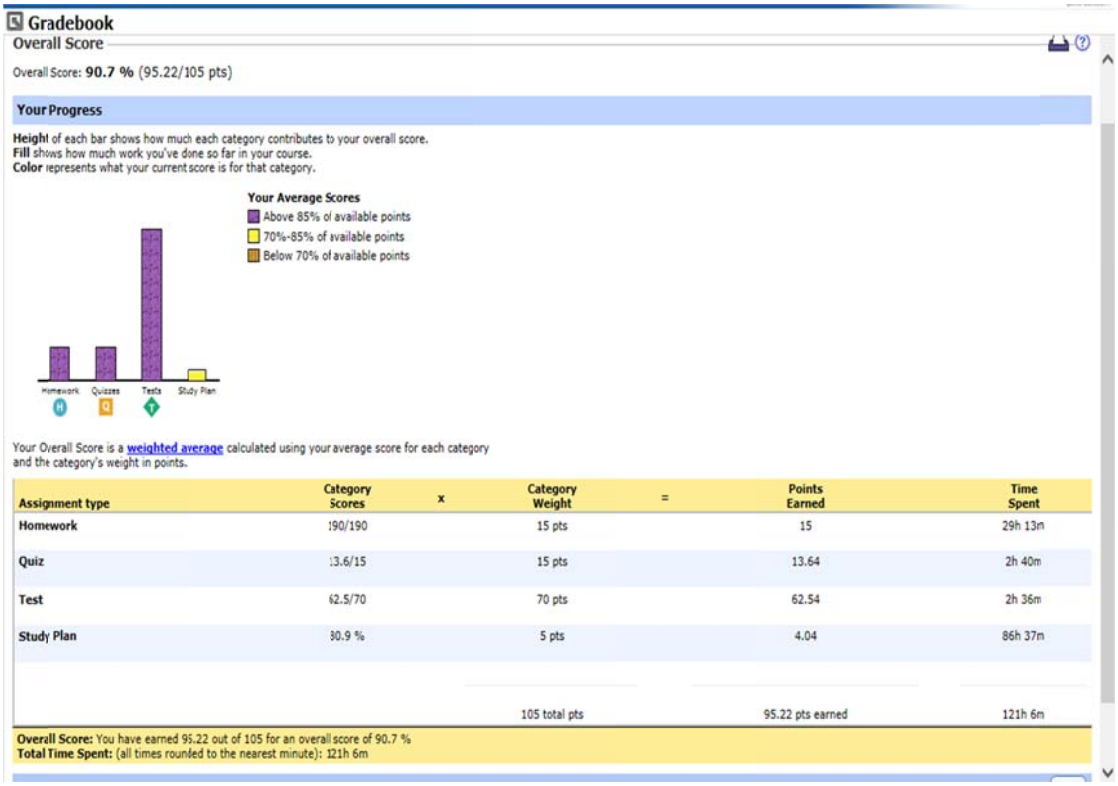


Fig. 7 Overall results of a student

In spring 2015 about 450 female and male Pre-Calculus students whom took the online midterm exam using MML. MML allow us to extract students' performance per objective, resulting in an immediate feedback for further improvement. Fig. 8 shows the benefit of using MML in determining how students performed per objective in the online assessment using MML.

We examined the effects with several groups participated in this study. We collected data from students' results who participated in the study versus the ones who did not. First, we investigated that whether there is a correlation between spending time in outside and their result. Second, we compared students' results before participating in the study and after participating in the study. Third, we analysed whether there is a significant difference in exams' results between students who participated versus the ones who did not. Fourth, we compared the overall average of all students who were in the study in this course of the Qatar University.

Objective	%Correct SP15	%Partial SP15	%Incorrect SP15	%Not Attempt SP15
Graph or evaluate the functions listed in the library of functions.	89.0%	0.0%	10.8%	0.2%
Graph or write piecewise-defined functions.	36.1%	61.9%	1.9%	0.0%
Graph or write piecewise-defined functions.	45.5%	50.4%	3.0%	1.1%
Graph functions using a series of transformations.	74.7%	4.3%	21.0%	0.0%
Graph functions using a series of transformations.	55.0%	37.4%	7.6%	0.0%
Graph functions using a series of transformations.	51.9%	41.3%	6.7%	0.0%
Graph functions using a series of transformations.	47.2%	50.6%	2.2%	0.0%
Graph linear functions and describe the behaviour of the function.	84.6%	15.4%	0.0%	0.0%
Use average rate of change to identify linear functions.	81.0%	6.1%	12.8%	0.2%
Graph functions using vertical and horizontal shifts.	68.6%	27.9%	3.5%	0.0%

Fig. 8 The benefit of using MML in determining how students performed per objective in the online

VII. Conclusion

Innovative and LMS teaching leads to a positive learning outcome and students often learn more through animated technology in teaching and by listening to their peers and teachers. They can easily share their views and review materials and ask the teacher to clarify any concepts to solve a problem. This creates an environment of virtual education. Many students argue that their ideas in the discussion board improve their critical thinking.

The data collected shows that our strategy of engaging students in virtual education using Blackboard has improved their performance in problem solving and critical thinking. Students were able to apply the learning concepts and critical thinking in dealing challenging question and new innovative projects. In MML we believe that the more time a student spend in Study Plan, the higher the chance of passing the course with higher grades. The study showed that there was a very strong positive correlation between completing the required questions in the study plan and students overall performance in the course. Consequently, Study Plan helped students to improve their math skills. We recommend the following:

1. All instructors should emphasize to their students the importance of use of Study Plan & homework and their effect on their performance.
2. Continuing monitoring students' performance in study plan and homework to alter those who are scoring poorly in the study plan for early intervention.
3. Use study Plan & homework results as early indicators of students' at risk
4. Use students' performance per objective for an immediate feedback for further improvement.

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