

Use of Online MOODLE to Create the Course to Improve Students' Fundamental Understanding

S. M. Dol¹, S. A. Halkude²

¹Computer Science and Engineering Department, Walchand Institute of Technology, Solapur, India

²Computer Science and Engineering Department, Walchand Institute of Technology, Solapur, India

¹sunita_aher@yahoo.com

²halkude60@gmail.com

Abstract: MOODLE (Modular Object-Oriented Dynamic Learning Environment) is free Learning Management System used for creating the courses in education sector. There are online MOODLE also available which can be used for this purpose. Online MOODLE like Gnomio or MoodleCloud are used to conduct small courses, Faculty Development Programme, etc. In the current study, the course on Database Engineering using online MOODLE and statistics of this course related to the usage is considered. This course was developed on online MOODLE Gnomio. This paper discusses the component of this course, statistics of usage of this course and feedback given by the students about this course.

Keywords: Database Engineering, MOODLE, Learning Dialogue(LeD), Learning by Doing (LbD), Learning Experience Interaction (LxI), Learning Experience Trajectories (LxT)

1. Introduction

Now days, online MOODLE platform is used for creating and conducting the courses. Moodle provides several opportunities for faculty members to transition from being 'the source of knowledge' to being a facilitator and role model in the process of knowledge and skills acquisition (Amandu, G. M. And et.al., 2013). As presented in (Blin F. and M. Munro, 2008), there are two different classes on the Moodle platform :resources and modules. The MOODLE platform provides several modules, such as Database, Lessons, Feedback, Labels, Assignments, Workshops, Chats, Forums, News, Glossary, Checklist, Wikis, Choice, Quiz, Survey, Feedback, Forum, Organizer, Book, File, Folder, SCORM (Sharable Content Object Reference Model) and External tools (<http://moodle.org/>).

S. M. Dol

¹Computer Science and Engineering Department, Walchand Institute of Technology, Solapur, India
sunita_aher@yahoo.com

Even it is possible to add block like Analytic Graphs, Completion Progress, Activity Result, Calendar, Comment, Blog Menu, Mentees, and Online Users etc.

In this current study, the course is created using online MOODLE <https://www.gnomio.com/> and the course site is <https://sunitamdoldbecourse1.gnomio.com/course/view.php?id=2>.

2. Related Work

In (S. Dol and et.al. , 2018), the MOODLE course on 'Active Learning: Think-Pair-Share and Peer Instruction Activity' was originally designed as part of FDP 301x – "Mentoring Educators in Educational Technology" where the participation and effectiveness of the course was analyzed on three factors namely, engagement pattern of participants, learning in the course and perception of users towards the course.

In (Sunita M Dol and Trupti S Indi, 2017), Open Education Resource (OER): C-Programming Handout based Lab Session using MOODLE was developed which consists of C-Programming Lab handouts for First Year Engineering students. This OER contain the useful guidelines for implementing the program problem statement in the lab session. This OER was developed as a part of Four week Faculty Development Program sponsored by AICTE on "Use of ICT in Education for Online and Blended Learning" from 2nd May to 10th July 2016.

The article (Carolina Costa et.al., 2010) described a study carried out at the University of Aveiro (UA), Portugal that analyzed the functionalities and tools of the Moodle platform and their use by the students while a questionnaire-based study was conducted to evaluate the use of the Moodle-based e-learning platform of the German Jordanian University, Jordan (Rana El Bahsh and Mohammad I. Daoud, 2016).

The article (Andrea North-Samardzic and Monash University, 2015) suggested that theoretical models of technology acceptance and use needed to evolve to appropriately capture the environment of higher education in which learning management systems such as Moodle are used. In (Naifa E. Saleem et.al., 2016), the authors explored the acceptance of Moodle as a teaching and

learning tool by the faculty of the Department of Information Studies (IS) at Sultan Qaboos University (SQU) in the Sultanate of Oman while the results of study (Lan Umek et.al, 2015) indicated that the implementation of an e-learning system (Moodle) at the Faculty of Administration, University of Ljubljana is related to a statistically significant increase in students' performance, measured as the average grade and the average number of admissions to the exams.

In the current article, I used various features along with peer assessment of assignment with the help of MOODLE activity Workshop.

3. Online MOODLE for Course Creation

MOODLE is an open-source learning management system to help educators create effective online learning communities. MOODLE is used for blended learning, distance education, flipped classroom and other e-learning projects in schools, universities, workplaces and other sectors [<https://en.wikipedia.org/wiki/Moodle>]. This platform is used in education system where instructor adds material related to the specific course and activities for students to complete. MOODLE has various features like course creation, easy backup, assessment, collaborative tools and activities, convenient file management, analytics, embedding of external resources, content repository, managing user roles and permissions, multiple progress tracking options, notifications and automatic alerts, outcomes and rubrics, peer and self assessment, personalized dashboard etc. The benefits of MOODLE are user friendly interface, easy to customize, offline access, content management, security, assessment and testing, etc. [<https://hurix.com/benefits-moodle-based-learning-management-system/>] I have used the online MOODLE [<https://www.gnomio.com/>] for creating the course for the students. The URL for this course is [<https://sunitamdoldbecourse1.gnomio.com/course/view.php?id=2>]. The self enrolment feature is also added on the home page so that anyone can log into the course and go through it.

4. Components of Course

The components of course conducted for Database Engineering course of Third Year Computer Science and Engineering are given below in figure 1:

- A. Welcome Note and Instructions
- B. Course Entry Feedback
- C. Introduction to DDL, DML, DCL and TCL
- D. Learning Objectives
- E. Learning Outcomes
- F. Key Concepts
- G. Topic-wise Contents
- H. Discussion and Reflection Quiz
- I. Advancing Your Learning
- J. Database Application using DDL and DML
- K. Evaluation and Feedback

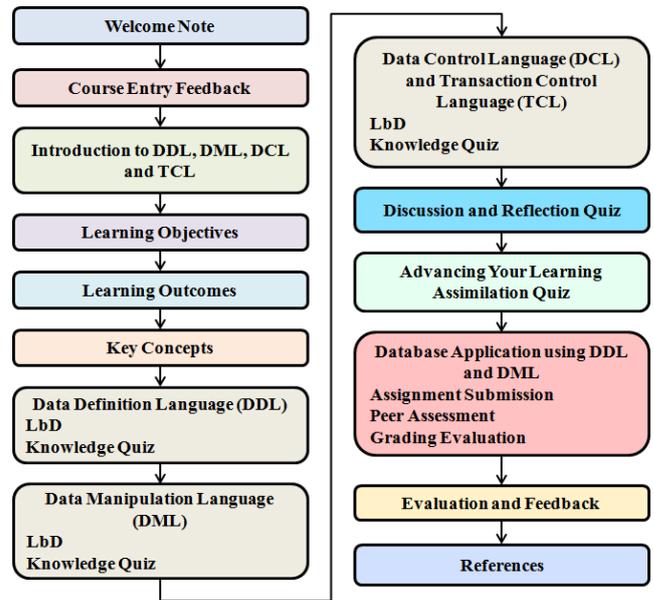


Fig. 1 Component of course

A. Welcome Note and Instructions:

This part contains the components of course and instructions about how to go through this course and attempt the same. This part also contains the important note.

B. Course Entry Feedback

Students entered course entry feedback which is used to know about the familiarity about the topics covered in the course. The question considered is - How much do you know about DDL, DML, DCL and TCL? The responses are given in the following table 1.

Table 1: Course Entry Feedback of students

Choice options→	Nothing at all	Partially	Know about DDL	Know about DML	Know about DCL	Know about TCL
Number of responses	22	30	21	16	1	1

C. Introduction to DDL, DML, DCL and TCL

Here the introduction to the topics like DDL, DML, DCL and TCL are considered so that students will get some idea about this course as shown in figure 2.

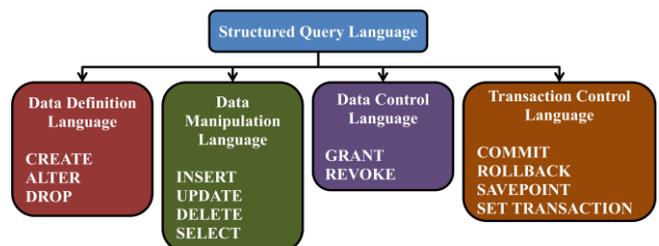


Fig. 2 Contents of course

D. Learning Objectives

The Learning Objectives of this course are:

- To create, alter and drop the relation in database using Data Definition Language commands
- To insert, update and delete the relation in database using Data Manipulation Language commands
- To grant and revoke the privileges on the relation using Data Control Language commands
- To control the transaction using Transaction Control Language commands

E. Learning Outcome

At the end of this course, students will be able

- To create, alter and drop the tables in database for given application using Data Definition Language commands CREATE, ALTER and DROP command
- To insert, update and delete the data in database for given application using INSERT, UPDATE, and DELETE command.
- To use DCL commands GRANT and REVOKE to control the access of various database objects.
- To use TCL commands COMMIT, ROLLBACK, SAVEPOINT and SET TRANSACTION to control the transactions.

F. Key Concepts

Following are the key concepts of this course:

- Structured Query Language (SQL)
- Data Definition Language (DDL)
- Data Manipulation Language (DML)
- Data Control Language (DCL)
- Transaction Control Language (TCL)

G. Topic-wise Contents

This part contains three topics namely DDL, DML, and DCL & TCL. Each topic contains Learning Dialogue (LeD), Learning by Doing (LbD) activities and one Knowledge Quiz.

Each LeD contains Learning Outcome, Reflection Spot, content following the Reflection Spot and References. Reflection spot is a point where the content is paused and the learner is required to answer a question asked based on the previously covered content. Reflection spot allows the learner to micro-practice or simply apply the concept that they have learnt immediately. Reflection spot may be a multiple-choice question, or fill in the blanks, or short answer question, etc. The goal of a learning dialog is to provide this conceptual knowledge along with explicit spots for learners to express their conceptions, do micro-practice and reflect on what they have learnt

Each LeD is followed by LbD. LbD is a formative assessment activity for students to self-check their level of concept attainment, or for them to immediately apply the concepts that they have seen and learnt in the LeD, or for integration of various concepts and various parts of the module in the MOOC. This activity is designed by instructor.

Knowledge Quiz is a graded activity which was based on the topics covered in videos.

Topics considered are given below:

- a) Data Definition Language (DDL)
 - i. LeD1: Data Definition Language (DDL) Video1
 - ii. LbD1: DDL Video1
 - iii. LeD2: Data Definition Language (DDL) Video2
 - iv. LbD2: DDL Video2
 - v. LeD3: Data Definition Language (DDL) Video3
 - vi. LbD3: DDL Video3
 - vii. Knowledge Quiz (KQ1) – DDL
- b) Data Manipulation Language (DML)
 - i. LeD4: Data Manipulation Language (DML) Video1
 - ii. LbD4: DML Video1
 - iii. LeD5: Data Manipulation Language (DML) Video2
 - iv. LbD5: DML Video2
 - v. LeD6: Data Manipulation Language (DML) Video3
 - vi. LbD6: DML Video3
 - vii. Knowledge Quiz (KQ2) – DML
- c) Data Control Language (DCL) and Transaction Control Language (TCL)
 - i. LeD7: Data Control Language (DCL)
 - ii. LbD7: DCL Video
 - iii. LeD8: Transaction Control Language (TCL)
 - iv. LbD8: TCL Video
 - v. Knowledge Quiz (KQ3) - DCL & TCL

The videos created for above topics are also there in YouTube channel as:

- Video 1 - DDL CREATE Command
<https://www.youtube.com/watch?v=BGiIZgw9JHY>
- Video 2 - DDL Constraints on CREATE Command
<https://www.youtube.com/watch?v=64XfUvdnoHc>
- Video 3 - DDL ALTER and DROP Command
<https://www.youtube.com/watch?v=JjUOIURs3u4>
- Video 4 - DML (Data Manipulation Language)- INSERT Command
<https://www.youtube.com/watch?v=p-C-kyUTXy0>
- Video 5 - DML (Data Manipulation Language) – UPDATE and DELETE Command
<https://www.youtube.com/watch?v=onpFu7eyqvg&t=23s>
- Video 6 - DML (Data Manipulation Language) – SELECT Command
<https://www.youtube.com/watch?v=h-aNhOXDUTA>
- Video 7 - DCL (Data Control Language)
https://www.youtube.com/watch?v=vOooc1Q5q_Y
- Video 8 - TCL (Transaction Control Language)
<https://www.youtube.com/watch?v=BttRblah-3s>

H. Discussion and Reflection Quiz

This part contains following two component

- i. LxI - Learner Experience and Interaction (Discussion Forum) on DDL,DML,DCL and TCL
- ii. RQ: Reflection Quiz

In LxI, focused question was given and following topics were assigned to the students for discussion.

Table 2: Topic assigned to students for discussion

Sr. No.	Topic name	Roll No
1	Retail Chain Management System	1 to 10
2	Hospital Management System	11 to 20
3	Library Management System	21 to 30
4	Railway Reservation System	31 to 40
5	Airline Reservation System	41 to 50
6	Students Information System	51 to 60
7	University	61 to 70
8	Employee Information System	71 onwards

I. Advancing Your Learning :

For Advancing your learning part of this FDP, two online sources were considered for advancing the students' knowledge about the Database Engineering course.

So this part of the FDP consist of:

- i. Learning Extension Trajectories (LxT) 1: https://docs.oracle.com/cd/B14117_01/server.101/b107
- ii. Learning Extension Trajectories (LxT) 2: https://way2tutorial.com/sql/oracle_sql_introduction_t on t
- iii. Assimilation Quiz (AQ)

Assimilation Quiz ensure that student assimilate the key concept or knowledge intended from the resource

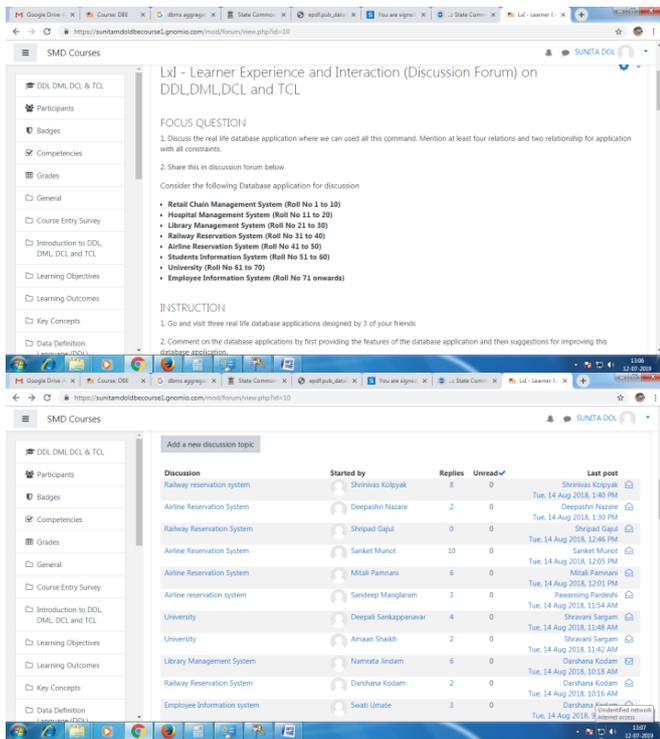


Fig. 3 Focus question and discussion by students in Learner Experience and Interaction (Discussion forum)

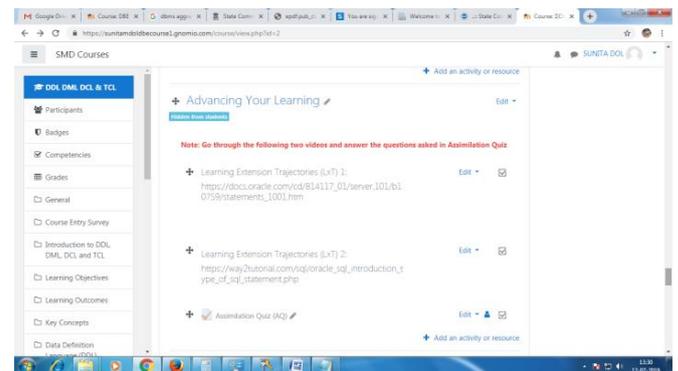


Fig. 4 Advancing Your Learning screenshot

J. Database Application using DDL and DML

This part contains:

1) *Database Application using DDL and DML*: Here the information about the database applications to be submitted by students and rubric to evaluate the assignment is given. Following table 3 represent the rubric to evaluate the assignment submitted by students.

Table 3: Rubric for Assignment evaluation

	Present	Partially Present	Not Present
CREATE Command	CREATE command is present for all mentioned relations and relationships	CREATE command is partially present for mentioned relations and relationships	CREATE command is not present for the mentioned relations and relationships
Primary Key Constraints	Primary Key Constraints is present for all	Primary Key Constraints is partially present	Primary Key Constraints is not present for

Reflection quiz helped the students to go back and review the discussions happened in order to answer the quiz questions. This quiz was based on discussion forum. The sample question is given here:

In the discussion thread started by Mahesh Jokare on Railway Reservation System, which of the following is the suggestion given by Pawansing Pardeshi Select one:

- a. You can add Aadhar number as an attribute to the passenger
- b. You have provided good tuples...for better understanding describe primary key etc.
- c. Mention Foreign Key also
- d. There is no foreign key

	mentioned relations and relationships	for mentioned relations and relationships	the mentioned relations and relationships
Foreign key constraints	Foreign key constraints is present for all mentioned relations and relationships	Foreign key constraints is partially present for mentioned relations and relationships	Foreign key constraints is not present for the mentioned relations and relationships
ALTER command	More than one ALTER commands are present.	Only one ALTER command is present	ALTER command is not present
DROP command	DROP command is present.		DROP command is not present
INSERT command	INSERT command is present for all mentioned relations and relationships	INSERT command is partially present for mentioned relations and relationships	INSERT command is not present for the mentioned relations and relationships
UPDATE command	More than one ALTER commands are present.	Only one ALTER command is present	ALTER command is not present
DELETE command	DELETE command is		DELETE command is not

	present.		present
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2) Database Application using DDL and DML Example Sample: Here the sample example of assignment was given so that students can understand what is to submitted in the assignments.

3) Database Application using DDL and DML Assignment Submission: Workshop activity was used for assignment submission and evaluation. After submission of the assignment, peer evaluation was done. Here each student was assigned three peers to evaluate the assignment. Peer Assessment using MOODLE activity- workshop is shown in figure 5.

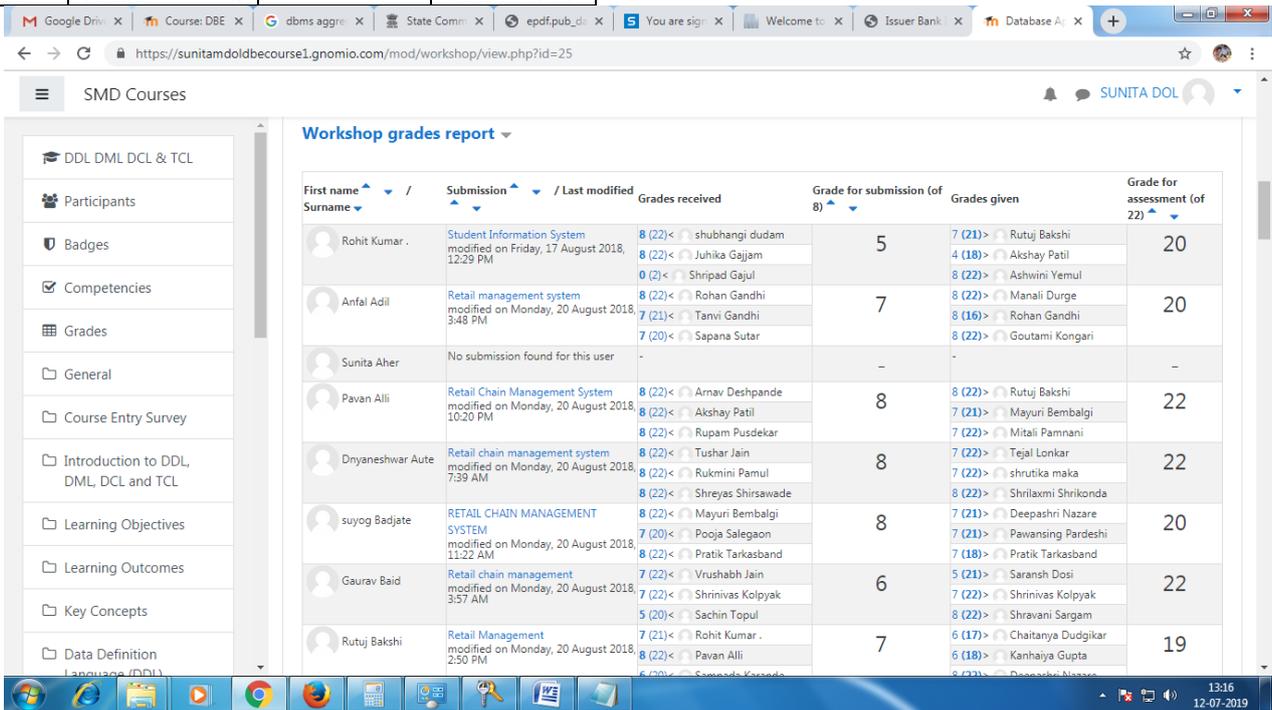


Fig. 5 Peer Assessment using MOODLE activity- workshop

K. Evaluation and Feedback

Here three types of feedback were considered for analyzing the overall perception of students:

i. Perception of Learning:

<https://docs.google.com/forms/d/e/1FAIpQLSefdVgyXp7kBdBZBusXrZirL>

ii. Perception of Engagement:

<https://docs.google.com/forms/d/e/1FAIpQLSeZ1Uqom0sfF5LI7kHjmGxmR>

iii. Perception of Usability:

<https://docs.google.com/forms/d/e/1FAIpQLSd3RdOOLvCIDgHQo6i2pMRD->

L. References

References used while designing this course are considered in this part of course.

This small course was conducted from 7th August to 27th August 2018. The details about the course content and count is given in table 4 while course content and deadline for each activity are given in the Table 5.

Table 4: Course contents and count

Sr. No.	Content	Number
1	LeD	8
2	LbD	8
3	KQ	3
4	LxI	1
5	RQ	1
6	LxT	2
7	AQ	1
8	Assignment using Workshop	1
9	Feedback	3

Table 5: Course Content and Deadline

Sr. No.	Content	Deadline
1	Data Definition Language (DDL)	LbD Knowledge Quiz
		7 th August to 8 th August 2018
Discussion and doubt solving session in the classroom – 9 th August 2018		
2	Data Manipulation Language (DML)	LbD Knowledge Quiz
		9 th August 2018
Discussion and doubt solving session in the classroom – 10 th August 2018		
3	Data Control Language (DCL) and Transaction Control Language (TCL)	LbD Knowledge Quiz
		10 th August 2018
Discussion and doubt solving session in the classroom - 11 th August 2018		
4	Discussion and Reflection Quiz	Reflection Quiz
		11 th August to 14 th August 2018
Discussion and doubt solving session in the classroom – 13 th August 2018		
5	Advancing Your Learning	Assimilation Quiz
		14 th August and 15 th August 2018
Discussion and doubt solving session in the classroom – 16 th August 2018		
6	Database Application using DDL and DML	Assignment Submission
		Peer Assessment
		Grading Evaluation
		16 th August to 20 th August 2018
		21 st August to 23 rd August 2018
		24 th August and 25 th August 2018
Discussion and doubt solving session in the classroom – 18 th August 2018, 22 nd August 2018		
7	Evaluation and Feedback	Feedback
		24 th August to 27 th August 2018

5. Evaluation Report

Research Question: Is this course created using online MOODLE useful?

A. Analysis of Engagement

The activity completion report generated from the course Reports section shows the engagement of participants in

the activities as shown in Table 6 while the graph is shown in figure 6.

Table 6: Activity Completion Summary

Activity	Completion Status	
Course Entry Survey	69	
LeDs (Learning Dialogue)	1	71
	2	71
	3	71
	4	70
	5	69
	6	67
	7	71
	8	70
LbDs (Learning by Doing)	1	71
	2	71
	3	71
	4	66
	5	66
	6	66
	7	70
	8	70
KQ (Knowledge Quiz)	1	69
	2	66
	3	69
Learner Experience and Interaction (Discussion Forum) on DDL,DML,DCL and TCL	69	
RQ (Relection Quiz)	67	
LxT1 (Learning Extension Trajectories)	69	
LxT2 (Learning Extension Trajectories)	69	
AQ (Assimilation Quiz)	59	
Design Database Application using DDL and DML	70	
Peer Database Application using DDL and DML	70	

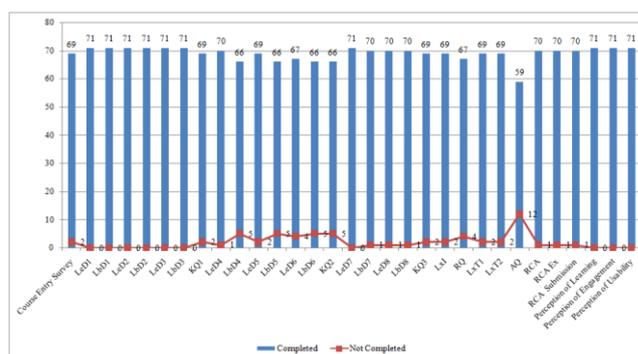


Fig. 6 Activity Completion Graph

B. Analysis of Learning

Analysis of the learning of the students is done by analyzing the marks obtained by the participants in attempting various quizzes and activities. There were five types of quizzes and activities for the participants. The average mark for each of them is given below:

Learning by Doing (LbD) Activities- 8 Nos [32 marks]

Reflection Quiz- 1 Nos [08 marks]
 Assimilation Quiz- 1 Nos [08 marks]
 Knowledge Quiz – 3 Nos [22 marks]
 Design and Peer Review of Database Application using DDL and DML [30 marks]
 Total 100 marks

SD- Strongly disagree
 MD- Mildly disagree
 N- Neutral
 MA- Mildly agree
 SA- Strongly agree

Number of participants who attempted each activity, the average marks and percentage they scored are given in the Table 7.

Table 7: Number of participants who attempted each activity, the average marks and percentage they scored

	LbDs	K Q1	K Q 2	K Q3	RQ	A Q	RC A	Any	All
No of students attempted	71	69	66	69	67	59	70	71	53
Average marks	29	5	6	5	7	7	27	84	89
Maximum marks	32	8	8	6	8	8	30	100	100
Average percentage	90%	83%	100%	83%	88%	88%	90%	84%	89%

Table 8: Number of participants who attempted each LbDs

LbDs	Lb D1	Lb D2	Lb D3	Lb D4	Lb D5	Lb D6	Lb D7	Lb D8	Any of the LbDs	All of the LbDs
No of Persons attempted	71	71	71	66	66	66	70	70	71	65
Average marks	4	3	4	4	4	2	4	4	3.6	3.5
Maximum marks	4	4	4	4	4	4	4	4	4	4
Average percentage	100%	75%	100%	100%	100%	50%	100%	100%	86.2%	81.4%

Number of participants who submitted the assignment, peer reviewed activities and the marks they have been given is given in Table 9.

Table 9: Number of participants who submitted the assignment, peer reviewed activities and the marks they have been given

	Design Database Application using DDL and DML	Peer Review of Database Application using DDL and DML	Total Marks
No of persons attempted	70	70	
Average Marks	7	20	27
Maximum Marks	10	20	30
Average Percentage	88%	91%	98%

C. Analysis of Perception

We analysed the overall perception of learners through their feedback in the three surveys. In all three survey, the abbreviations are used as follows:

- Perception of Learning: For each of the parameters to analyse perception of learning as shown in table 10 and figure 7, it can be seen that the students seem to have a good perception about the learning offered by the course [https://docs.google.com/forms/d/e/1FAIpQLSefdVgyXp7kDbBZBusXrZirL].

Table 10: Perception of Learning

	SD	MD	N	MA	SA
I was able to relate each of the learning objectives to the learning I achieved.	2%	0%	8%	25%	63%
I understood the learning objectives.	0%	2%	3%	27%	68%
I was appropriately challenged by the course material.	2%	0%	7%	33%	58%
My learning was enhanced due to the course material.	2%	0%	0%	17%	81%
I will be able to immediately apply what I learned.	2%	0%	10%	28%	60%
I feel motivated for advanced training on the subject.	0%	0%	12%	28%	60%
The additional resources/reference materials offered in-depth knowledge on the subject.	1%	0%	12%	20%	67%
I gained a new perspective by participating in the discussion forum.	3%	0%	3%	18%	76%

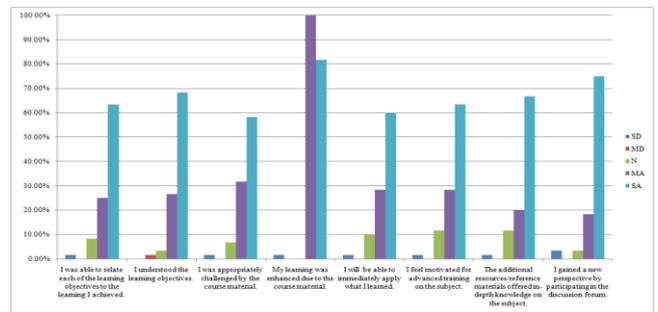


Fig. 7 Analysis of Perception Graph

- Perception of Engagement: It is observed from feedback given in Table 11 and figure 8 that the students are easily able to get actively involved each time they access the course and find the additional resources/reference materials engaging enough [https://docs.google.com/forms/d/e/1FAIpQLSeZIUqomOsfF5LI7kHjmGxmR].

Table 11: Perception of Engagement

	SD	MD	N	MA	SA
I was well engaged during the course.	2%	0%	5%	20%	73%

It was easy for me to get actively involved each time I accessed the course.	2%	2%	7%	23%	66%
I was given ample opportunity to practice the skills I was to learn.	1%	0%	7%	31%	61%
I found quizzes/activities interesting.	2%	0%	3%	17%	78%
I found the discussion forum threads motivating enough to participate regularly.	3%	2%	8%	20%	67%
I viewed/read all the additional resources/reference materials.	3%	0%	11%	39%	47%

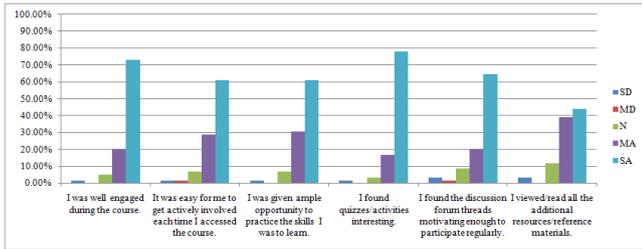


Fig. 8 Perception of Engagement Graph

- Perception of Usability: from feedback shown in Table 12 and figure 9, we can see that most of the participants have agreed in the range of Mildly and Strongly on the usability of the course [<https://docs.google.com/forms/d/e/1FAIpQLSd3RdOOlvCIDgHQo6i2pMRD->].

Table 12: Perception of Usability

	SD	MD	N	MA	SA
I found the course materials easy to navigate.	2%	0%	8%	18%	72%
I was comfortable with the pace of the program.	3%	1%	12%	18%	66%
I was comfortable with the duration of the session. Show	2%	0%	8%	31%	59%
I found consistency in the course material design.	1%	0%	5%	27%	64%
I found the course material clear and understandable.	1%	0%	2%	19%	78%
I was given ample opportunity to share my suggestion/feedback.	2%	0%	5%	25%	68%
I was given ample opportunity to get answers to my queries.	2%	2%	1%	29%	66%
I found the discussion forum threads relevant.	1%	0%	8%	19%	72%
I think that I would like to frequently use what I learnt.	2%	0%	1%	19%	78%

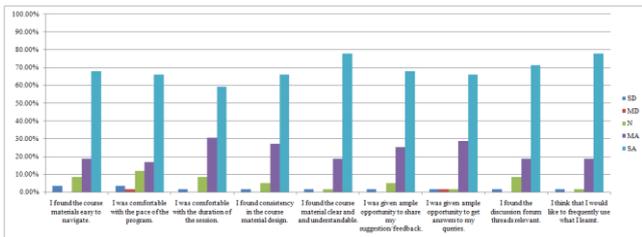


Fig. 9 Perception of Usability Graph

6. Conclusions

The gross data about engagement shows that the numbers of students completing the activities/quizzes are good. Also, from the data on scores of students, we can see that the scores of the students in the final Knowledge Quiz (KQ) are also good. The average assignment score is good. This indicates that the perceived learning value of the course is good. This course created using online MOODLE is useful for students from table 6 and 7. Such courses can be created for any course using online MOODLE.

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