Breaking the walls of classroom through Micro learning: Short burst of learning

R K Dixit[1], P S Yalagi[2], M A Nirgude[3]

[1] Department of Computer Science & Engineering, Walchand Institute of Technology, Solapur
[2] Department of Computer Science & Engineering, Walchand Institute of Technology, Solapur
[3] Department of Information Technology, Walchand Institute of Technology, Solapur

Abstract

To avoid spread of novel corona virus, in the second week of March, state government advised to close schools & colleges till further announcement. There was no certainty about reopening. This was a decisive time for the education sector to switch from physical classroom teaching to online classroom teaching. The primary objective of our institute was continuous learning and facilitates teaching-learning process through online teaching. It is an observation that few courses are found to be difficult for students even in physical classrooms and teacher need to employ different active learning strategies to make class active & engaged. Thus same issue was found in online teaching. Therefore we employed micro learning strategy for the course Theory of computation at S.Y. B.Tech.(Computer Science & Engineering). “Micro learning is a holistic approach for skill based learning and education which deals with relatively small learning units.[1]” In this approach, micro level activities were designed, each activity containing a series of short videos, quiz & assignments. Thus we have designed 25 micro level activities for 2 units covering 25% curriculum. Flipped classroom is used as instructional strategy while implementing micro learning. These activities helped to engage students and keep active even in online environment. Tests conducted at the end of topic and perception survey showed that students enjoyed while learning.

Keywords: Covid pandemic situation, online classes, learning strategy, Micro learning, short videos, activities

1. Introduction

Theory of Computation (TOC) course is the study of abstract machines and is applied in Compiler construction and designing programming language. The course covers designing of abstract machines like finite automata, Pushdown Automata and Turing Machines which is bit hard for students to visualize & understand. Hence, we employed instructional strategies such as Think-pair-share (TPS) & visualization during course delivery. Up to Second week of March, traditional classroom teaching happened but then suddenly lockdown was declared because of corona virus. To avoid spread of novel corona virus, in the Second week of March, state government advised to close schools & colleges till further announcement. Though our institute was also closed, the primary objective of our institute was continuous learning and hence we have shifted immediately to online classroom teaching, accepting the reality. Problem solving & designing abstract machines were found difficult for students in traditional classroom and which has become more difficult task in online classroom. Since no perfect platform was available for online teaching at the beginning, online teaching & explaining topics of TOC was more difficult for both teacher and students, Therefore in order to ease this process and increase students’ understanding, we employed micro learning strategy for this course which is at S.Y. B.Tech.(Computer Science & Engineering) in our curriculum which is the most suitable technique for online teaching.

Micro learning is a learning technique in which a series of short learning content and short activities. As it is planned, bite-sized chunks of units or activities. It is designed to match with limits of the students’ attention span and avoid cognitive overload during Covid pandemic situation. Micro learning exists for a long time which supports the integrating technology to create learning environments and is also growing in the field of higher education as well as in corporate field.
According to Hug (2006), there are seven components of micro learning: time, content, curriculum, form, process, meadiality, and learning type which are important during design aspect of micro learning. Along with these seven elements, pedagogy and technology aspects, which are key elements to an effective micro learning design. Content, pedagogy and technology are the three elements in creating an effective micro learning environment as shown in Figure 1.

![Micro learning model](image)

**Figure 1 : Micro learning model [1]**

1.1 Content
The content is the first element in creating a micro learning environment. Process starts with the identification areas in curriculum and technology integration for micro learning. Things that are considered while creating contests are: what students want to know and understand, which topics can be broken down into small parts, what is the most suitable activity outside classroom for students etc. These questions help in identification of flow of content. Once content are created, it is essential to think about the pedagogical model to use while designing micro learning environment.

As per university curriculum, every semester comprises of 15 weeks. Before lockdown, 11 weeks were completed and 25% syllabus was remaining to be covered. We have identified topics and created contest accordingly.

Another important element that needs to consider while using the micro learning technique understands the characteristics for designing and creating an effective digital-based micro learning environments. For learning in small bits, contents can be designed using one of the digital formats (e.g. short videos, podcast, and animation). Contents shall be created such that learner requires 3-5 min to complete. Content segments can be followed by assessment to understand students engagement & learning in the form of low-stakes quizzes. Around 15-20 min are taken together to complete all the segments of activity.

1.2 Pedagogy
Before adopting any pedagogy, instructor must be capable enough to find out - what are the must-to-know information, which part are ok-to-eliminate information. Along with these entire just single specific learning outcome shall achieve by breaking down large topic into smaller unit. We have used Flipped classroom as instructional strategy in this micro learning environment.

1.3 Technology
After Content & pedagogy, Technology has critical part in micro learning. To engage students outside of classroom is hard for instructors to keep up balance between self reported and technology knowledge.
In a micro learning, it is important to think about appropriate choice of technology to design based on micro learning characteristics. **Micro learning** is an excellent way to learn on mobile. Mobile devices are perfect to access micro content, as learners are able to interact with small pieces of content on the fly. Many of the technologies used in the classroom now a day are having mobile friendly applications. In addition, the numbers of students who own mobile devices continue to increase. For this reason, digital micro learning environments should use mobile friendly applications, to allow learners to complete learning activities on their devices.

2. **Literature review**

Time, content, curriculum, Form, Process, Mediality, learning types are the different dimensions of Micro learning which are explicitly or implicitly create awareness [1]. Liu, Z. Wei, L., Gao, X. (2016) found that more than 75% graduate studying students took active part in micro learning teaching activities. They also commented that it promotes multi-dimension interaction at the same time deep-leveled understanding [2]. Aitchanov, et. al. (2013), examined the use of a social media technology, in a micro learning technique for educational purposes. In the era of internet, web micro learning can be combined with any Digital form for better result [3]. Study on data collected by University level courses results, by Bruck, P. A., Motiwalla, L., & Foerster, F. (2012) high level usage of course material with satisfaction level[4]. Increasingly large and increasing influence of social media and networking, instructors try to find a new ways to engage students in learning and. The use of social media and micro learning offer other many possibilities, like creating a collaborative learning environment [5]. By considering three elements i.e. content, pedagogy, and technology micro learning surely imposes positive effect on increases student engagement, satisfaction, learning experience [6]. The micro learning ensures that students are engaged in the online content outside of classroom and also claims micro learning can contribute to the construct of an authentic learning environment in higher engineering education also [7]. The case study states that it is a way to support easy going and autonomous learning in an organization motivated both students and instructor [8]. Author proposes a way development of a micro-learning content instead of existing of elearning and provide made-to-order contents considering the learners’ both time and status[9]. Junfei Zhang, Chuanxue Wen present combination of micro lecture and mobile learning as MMLS (Microlecture Mobile learning ) to gave a higher evaluation of the curriculum. [10]

3. **Implementation Details**

“Theory of computation science” course is taught at Department of Computer Science & Engineering. It prepares base for understanding courses such as system programming, compiler construction. Due to lockdown in March 2020, @25% syllabus coverage was pending. To continue students’ learning, we first started providing e-Learning material in the form of PDF documents, videos. Then everyone realized that Online teaching was the need of the hour. During traditional teaching for the course like TOC, it is possible to design machine on black board and also provide more attention to slow learner which we found somewhat missing only using e-learning material. Micro learning technique which integrates contents, pedagogy and technology is the most suitable technique for content delivery for the courses in this situation and hence we created Micro learning Framework. We started with Content identification, pedagogy to be used and technology identification. We have covered two units (Turing Machine & Variations on Turing Machines) using this technique. Curriculum for unit Turing machine is listed in Table I, prescribed by university.

| Table 1 : Content for Unit Turing Machine (TM) |
|----------------------------------------------|
| Turing Machine definition                     |
| Computing partial function using TM           |
| Combining Turing Machines                     |
| Variations of Turing Machine                  |
| Non Deterministic TM                           |
After identification of topics, these topics were further broken down and content designed by aligned to Learning Outcomes of course as listed in Table II.

| Day | Designed Content |
|-----|------------------|
| 1   | Introduction to Turing Machine |
| 2   | Comparison of Turing Machine with Pushdown Automata and Finite Automata |
| 3   | Design a TM to accept Regular Language |
| 4   | Design a TM to accept Context Free Grammar |
| 5   | Design a TM to accept Palindrome |
| 6   | Construct a TM for Computing Function |
|     | - Addition of two Number |
|     | - Subtraction |
|     | - Division |
|     | - Multiplication |
| 7   | Combining TM |
| 8   | Variation in TM |
| 9   | Non Deterministic TM |

As Micro-learning pedagogy refers to breaking large part into small chunks, the above contents are prescribed on that basis only. After first stage i.e. content identification, contents are created in digital form (videos). Videos are recorded using Smart Phones at home by instructor. Three videos are recorded, each of 4 minutes duration to cover one daily content. These videos were sent to class Whatsapp group. These created contents can be watched by students at own pace. Instructor created videos cresting traditional classroom environment using a white board and recorded video using Mobile maintain quality of audio and video. Next day morning, before posting next videos, short quiz is conducted on previous content to get the instant feedback about students’ understanding. Discussion was held in case needed. Additional assignments were given using Google classroom. Thus Flipped classroom approach is used, only instead of discussion in physical classroom, it happened in online classroom.
White board along with regular Smart board is used to record videos at home only. No extra facility is required. Whatsapp is used as a mode of communication. Zoom is used for discussion purpose. Google Classroom is used for assignment submission. On each day videos are recorded by keeping focus on single learning outcome.

Technology used for Micro learning Framework:
1. Content creation: Smart Phone
2. Content Dissemination : Whatsapp Application & Google Classroom,
3. Discussion in online classroom: Zoom
4. Assessment (quiz) : Google form
5. Assignment : Google classroom
Micro learning concepts, based on mobile web learning, provide an alternative to classroom education. Micro contents are a small burst of learning objects with the knowledge input. This experiment tried to bridge the gap between traditional classroom teaching and online teaching.

Even though more preferences were given to learning based on electronic devices, it also have disadvantage like awareness. Internal Assessment was done but since examination is cancelled we could evaluate students’ performance at university level examination. We designed survey questionnaire to get students’ perception.

Feedback responses show that micro learning is highly useful for knowledge acquisition irrespective of classroom irrespective of classroom. More than 80% students are happy with micro learning activity.

4. Conclusion & Discussion
Micro learning model ensures that students’ active participation in inside as well as outside classroom and increase students’ engagement. It does help individuals to learn in precise manner micro content. Instructors also targets on the learning experience while designing micro learning. Micro learning can be applied for any course to make teaching-learning more interesting.
5. References

1. Theo Hug, “Micro learning: A New Pedagogical Challenge”, conference micro learning 2005: Learning & Working in New Media Environments, held on June 23 - 24, 2005 in Innsbruck (Austria).

2. Liu, Z., Wei, L., Gao, X. (2016). A Study on Self-regulated Micro-course Learning and Implicitly Layered Flipped Classroom. Theory and Practice in Language Studies, 6(4), 870-877. Doi: 10.17507/tpls.0604.27

3. Aitchanov, B., Satabaldiyev, A., &Latuta, K. (2013), Application of micro learning technique and Twitter for educational purposes. Journal of Physics: Conference Series, 423, 1-4. Doi: 10.1088/1742-6596/423/1/012044

4. Bruck, P. A., Motiwalla, L., &Foerster, F. (2012), Mobile learning with micro-content: a framework and evaluation. 25th Bled eConference. Retrieved from www.bledconference.org.

5. Lumița Giurgiu “MICRO LEARNING: AN EVOLVING ELEARNING TREND,”, Scientific Bulletin Vol. XXII No 1(43) 2017

6. Emtinan Alqurashi, Ed.D : “Creating a Micro learning Environment to Facilitate Retention of Information: A Three-Step Approach”, The 41st Annual Association for Educational Communications and Technology (AECT) Proceedings, Vol 2, 249-252, 2018

7. Emtinan Alqurashi, “Micro learning: A Pedagogical Approach For Technology Integration” Conference : International Educational Technology Conference at Harvard, Cambridge, MA, 2017

8. P. de Vries, M. van den Bogaard, M.G.F. Overschie, “Microlearning to support authentic learning in continuing education and for engineering students”, Conference: SEFI 2018 - Creativity, Innovation and Entrepreneurship for Engineering Education Excellence, Sep. 2018

9. Rebeca P. Díaz Redondo, Manuel Caeiro Rodríguez, Juan José López Escobar & Ana Fernández Vilas, “Integrating micro-learning content in traditional e-learning platforms”, Springer, Published: 19 September 2020

10. Junfei Zhang, Chuanxue Wen, “Design of a Microlecture Mobile Learning System Based on Smartphone and Web Platforms”, IEEE Transactions on Education 58(3):1-1, November 2014