EVOLUTION OF SMART PEDAGOGIES WITH DIGITAL GADGETS

Karthikeyan Ramiah [1] | Pandian Pitchipoo [2]

[1] Department of Mechanical Engineering, PAC Ramasamy Raja Polytechnic College, Rajapalayam, India.

[2] Department of Mechanical Engineering, PSR Engineering College, Sivakasi, India.

ABSTRACT

Up to the last century, teachers and their lecture notes were the only resources available for the learning community. Some of the reference books, publications, and research manuscripts available in the libraries in the form of hard copies, stencils, photo copies, hints, manual written scripts, etc made the learning process more difficult. Now, in the era of Digital Transformation all information is available in the digital formats with more detailed descriptions. These resources can be easily accessed by anyone from any place and at any time. Hence the task of bringing the learners to the class rooms made tedious. The responsibilities put on the shoulders of the teaching community apart from teaching-learning process are also increasing exponentially. If the digital resources were effectively used with the support of smart class rooms, the teaching learning process will be a fruitful system with multiple benefits to all stake holders. This article explains various electronic (eLearning) and mobile (mLearning) learning gadgets and techniques available to enhance the delivery of lecture sessions more lively and effectively.

KEYWORDS: teaching learning process, eLearning, mLearning, smart class rooms, 3D Printer.

I. INTRODUCTION:

In India, the term school was introduced in the year 1880 by the people of British Missionaries for training the children of British soldiers. As pr the reports of Kothari Commission (1966) and Yashbal commission (2005), the recent schooling programme increases the division among the communities and decreases the interactions among the society and corporate people. This method was found to be give importance to the teacher-centered class rooms. Even though this method was found to be not more effective, whatever we achieved up to till date can be said as the results of this education system. From the small toy manufacturing company to aero space industries, production of home appliances to heath care products, labour level to managerial level administration, law, financing, etc., almost in all the domains, our education system is found to be successful (Natarajan R, 2014).

A,S. Makaenko built an education system called "Karki Colony" in which he taught skill based education to the poor youths of Russia and it was a successful system (Anton Semenovich Makarenko, 2004). He taught the importance of learning instead of teaching to the students. He told that school will impart knowledge and the family should inculcate the culture and habits system among the students (Anton Semenovich Makarenko, 1951).

Unfortunately after the fast global changes happened in field of digital information like creation, editing, storing, sharing, viewing, and providing security to those data, the teaching communities face a threat of attracting the students to the class rooms. The students are having a full degree of freedom in their learning style. The digital resources are available at any time, any place and any format such as documents, audio or video notes, presentation files, animated files, etc. These make the learners to become very impassionate in attending the regular lecture sessions.

In this article various eLearning and mLearning resources and pedagogies available now a days are elaborated to mould any teacher towards delivering an effective lecture session to the learners and to create passion among the learning community to attend and listen to the regular lecture sessions.

II. INNOVATIVE PEDAGOGIES:

The terms eLearning refers to electronic learning and mLearning refers to mobile learning and both of them uses the digital information to make the teaching and learning process more effective. These are a kind of learning process with the help of new technologies such as educational apps, programs, podcasts, blogs, online tools etc. Now a day, each and every student owns a smart phone, a tablet, or a laptop.

The Gadgets available have transformed from toys into very useful educational tools. The benefits of using these kinds of new pedagogies are flexible and mobile, continuous learning process, age independence, provides quick and easy access to information, high efficiency, higher levels of motivation and engagement, and learning access for people with disabilities (Eastern Peak, 2016).

Some of the online learning systems are Swayam, NPTEL, Mooc, Edx, Coursera, Udacity, Udemy, Khan academy, Skillshare, Harvard university, Ted, Alison, Futurelearn, Open learn, etc.
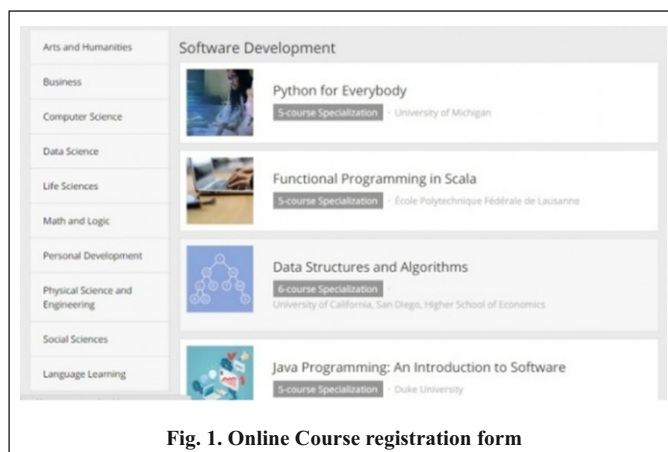

Fig. 1. Online Course registration form

In this article, it is planned to discuss about some of the teaching pedagogies those will enhance the teaching learning process using smart class rooms with the available digital information. This digital information may be in the form of text, images, photos, conceptual scripts, notes, 3D models, animated movies, annotations, audio and video treats, etc.

A. Virutual Reality:

Virtual Reality (VR) refers to the an immersive and interactive experience based on graphic images in 3D generated in real time by computer. VR technology is a simulation generated by a computer, about a real or just an imaginary world. VR is a computer interface that permits the user to interact in real time, in a tridimensional space generated by a computer, using their feelings, through special devices. The user ca notice the virtual world, through a window built by the monitor screen or by projection screen or it can be inserted in the real world through a helmet (HMD) or multi projections rooms (caves) and interaction devices (Claudio Kirner, 2018). Using the VR technology, the student can manipulate virtually the target that must be explored, analyzed and studied.

Generally the VR technology is characterized by three basic ideas such as immersion, interaction and involvement. Immersion makes the user to get the real sensation of being inside the virtual world of the computer using the devices digital helmets and digital cave. Interaction uses the digital gloves to manipulate the virtual objects by the user. Finally Involvement motivates the user to took part in the virtual world by means of exploring the virtual environment. Using this VR technology the user can interfere directly in result of the application, the user can navigate on the virtual environment in a passive or active way.

The VR technology makes the teaching learning process more interesting and fun with the purpose of improving the motivation and attention which are pleasant to the students. It facilitates the teacher's work during the evaluation performance. Further, it presents an opportunity of learning with a real situation which was artificially created, facilitating the visualization and the interaction sensa-

tion with the study focus. If there is no opportunity to get real world experiences, VR will be fruitful. VR based simulations permit the learners to understand the complex themes of hard learning easily (Adriana Soares Pereira et al., 2012).

Fig. 2. Samsung Gear VR

An example of VR app is the Xolius which is an application for astronomy learning. The study shows the effective implementation of VR technology in subjects where an interactive environment is needed. Further VR technology can offer an immersive experience, involvement and promoting active learning in comparison to the mobile application (Carl Nätterdal and Mustafa Hussein, 2015).

B. Augmneted Reality:
Augmented Reality (AR) turns the class room into a digital interface by placing virtual objects in the real world, in real-time. AR platform generates 3D model visuals for the students and teachers in the real environment, in real time, and at scale. This method of teaching changes the way the learners see, imagine, and learn about the world around them.

The tools used for the effective usage of Augmented Reality are AR 3D viewers, AR browsers and AR gaming. (i) AR 3D viewers allows users to place life-size 3D models in the class room environment with or without the use of simple images that 3D models can be attached to called as trackers. (ii) AR browsers enrich the display with contextual information required for the learners. (iii) AR gaming creates immersive gaming experiences that utilize the actual surroundings. To produce an augmented reality environment to the learners, the teacher can use devices such as simple mobile devices, PC connected multimedia players, head mounted displays, goggles, and lenses, etc. Since the effective teaching learning process involves creativity and interactions, AR technology will make the classroom lecture sessions more engaged and information are easily inculcated (Augment, 2020).

AR will provide more digital information about any subject, and make the complex phenomena to be understood easier. AR technology provides a platform for a new way and additional ways of teaching with the flexibility in the location and timings. AR based animated contents will enhance the learning ability of students and attracts them towards more learning. Since AR can provide rendered 3D models with real time scenario that are hard to imagine, AR makes the students to grasp abstract and difficult content in an easier way. AR apps help the students to learn a better knowledge of any lesson when compared with manual training, hand exercises, quiz solving etc. Especially for the medical students, AR will be a best way of to learn human anatomy by exploring more deeply.

Fig. 3. Application of AR in machine assembly

Some examples of the AR based apps used in the class rooms are Aursama, Elements 4D by DAQRI studio, Anatomy 4D, Corinth Micro Anatomy, Human Heart 3D, and AugThat, etc. For teaching kinder garden students, the widely used apps are Math alive, Animal Alphabet AR Flashcards, ZooKazam, Bugs 3D Quiver, Chromville, Arloon Plants, Pete the Cat: School Jam, Amazing Space Journey, SkyORB 3D and Star Walk, etc. In spite of the developments, the use of Augmented Reality in education is still new and under research. With the help of AR technology, teachers can get the attention of students and motivate them better and the students get new tools to visualize their subjects and complex concepts, as well as obtain practical skills (Think Mobiles, 2019).

The advantages of implementing the AR technology in the teaching learning process are Accessible learning materials at anytime, anywhere, no special equipment is required, higher student engagement and interest, improved collaboration capabilities, a faster and more effective learning process, Practical learning, Safe and efficient workplace training and Universally applicable to any level of education and training. The limitations that restrict the implementation of AR technology are the lack of necessary training, Dependence on hardware and Content portability issues (DZone - AI Zone, 2019).

C. Kindle Notebook:
Chris Edwards, a school teacher handling social studies subject in Indiana, started to use this device and suggest this as a hand held library. Any digital electronic book can be downloaded and eliminated the usage of regular printed text books and course materials. Preston L. Coppels, Director of instructional services for Loudoun County Public Schools in Ashburn, Virginia assessed the developments in e-book readers and other devices like netbooks and smartphones and concluded that the textbook was no longer the Holy Grail. This device is larger than an average paperback but smaller than a laptop, lightweight, and is a portable one. Since there is no backlighting, it consumes less power. Daniel Witz, a language arts teacher at Lake Bluff Middle School, near Chicago narrated that this device ensure the delivery of right material to the right student at the right time wit out loading any human being or any photocopying system. Cornelia Brunner, Deputy Director, Center for Children and Technology, New York City stated that Kindles would provide a new pavement for teaching strategies. Chastity Pick, a computer lab teacher in Fairbury, Illinois expressed the text-to-speech audio function available in the Kindle device will reduce the challenges faced by students with vision problems, language barriers, and lack of reading fluency, etc. Almost all the leading publishers like Cengage Learning, Pearson, and Wiley have entered in this field of electronic text book printing and supplying (Scholasatic Teachers, 2019).

Fig. 4. Kindle Gadget

The durability, difficulty in handling, and non – provision of connection to the overhead projectors, lack of provision for personalized learning, etc made the device of little interest for the teachers (Kindle Education, 2019).

D. ESL fast:
ESLFAST is a huge free online English learning resource available at free of cost to us. This software makes the learners to speak easy by involving them in the conversations given in their website (ESL Fast, 2019).

E. Goolgle translate:
An excellent tool for teaching languages is the Google Translate which can be operated using a smart phone or an iPod. It has a strong vocabulary and grammar of around 103 languages. It facilitates the copying of text created in any application and can be translated to the required language using this app. It can translate the text in to 59 languages even there is no net connection. The text can be scanned by the camera and can be translated in to any one of the available thirty eight languages. Google Translate can translate online two way speech interactions. The words can be dictated and can be translated and the pronunciation of the translated text can be also listened by the user. Even the handwritten text can be easily recognized and can be translated.

Fig. 5. Google Translate app

F. Mobile Apps for Engineers:
In Mechanical Engineering domain, an important subject is Strength of Material also called Mechanics of Materials which deals with various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The mobile app developed to teach this subject is a complete handbook with diagrams and graphs and can be used as a ready reference guide. It covers 157 topics starting from simple stress to stress in thick cylinders, preparing Shear Force Diagrams, and Bending Moment Diagrams for the structural members. It is portable, hand held, having provisions for setting remainders, tracking the learning levels, adding favorite topics, and sharing them in the social media (Google Play, 2019).

A part of MultiEducator's iPhone "Formulator" Line contains over 300 mechanical engineering formulas engineering formulas. There are over 300 additional conversion formulas within the program also as 70 area formulas. Major areas covered within the program include almost all the machine components, fluid power designs, heat transfer and refrigeration design, energy calculations, heat balance sheet, COP and efficiency calculations and automobile drive designs.

Autodesk's web and mobile named AutoCAD WS app lets the user to look at , edit, and share DWG drawings through an internet browser or mobile device. It has a number of design features which makes the design process more easy for the learners.

Aa parametric section and member calculator APP named Cross Sections Calc is launched by IPROBLUE Tech's. This App computes 21 geometric and mechanical properties for 23 commonly used sections utilized in beam and column design also as general mechanics of materials.

Mech Ref app is a reference for all mechanical components. It offers drill and tap sizes, fastener clearance holes, sheet metal gauge tables, and physics references. Mechanics Basics app contains a large selection of mechanics laws, equations, tables, and reference material that engineers may find useful during their work.

G. Moodles online test:
Moodles is of the best open source for the Learning Management System that can be used for making an effective teaching learning process. Especially this Moodles is found to predominant in conducting examinations to evaluate the performance and understanding level of the learners.

Questions can be prepared in the XML file format and can be uploaded easily in the Moodles platform. Questions of Multiple choice questions, True or False, Confidence, options, etc are accepted by this software and lot of shuffling actions are available for presenting the questions to students. Schedule of examination, number of attempts, time duration, students groups, different type of enrollment to these examinations are possible with this Moodles software. Students are given freedom to skip questions which can be answered in the later stage of the examination process.
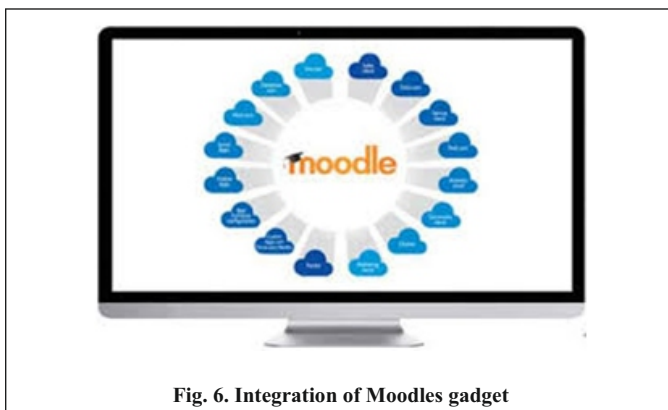

Fig. 6. Integration of Moodles gadget

The results of the performance measures can be reviewed in any format as per our requirement and can be easily downloaded or exported to any commonly used software. Special kinds of graphs, charts can also be generated for the evaluation process. Time consumed by the student, overall scores, scores obtained for individual outcomes can also be extracted from this software. Moodles is very much helpful for the training providers and teachers to know which module students are lacking and in which they are performing well and accordingly they plan the future course and lecture plans to make the teaching learning process more effective (Ample Trails 2019).

H. Robots:
It has been found that students were really happy while learning with the help of a robot irrespective of the subject. Since the robots are not given full autonomy, the entire control is in the hands of the teacher which makes the learning process more interesting. The proper usage of humanoid robots makes the teaching learning process more effective and can act as a teaching tool in the future class rooms. The technical limitations such as unnatural voices, inaccurate speeches, and lack of emotion recognition of these robots are acting as barriers to the successful implementation of these robots in the classroom environments. The robots configuration may vary from boebot to humanoids depending upon the lecture plan and the learning level of the students.

While the robots having basic and advanced configurations are widely used for teaching science, mathematics, and engineering subjects, the humanoids are preferred to teach language subjects like Japan, and South Korea. The robots named Pepper, Nao, Robovie, Toro, and IROBI are mainly used to teach English language. The main intension is to use robot as a teaching tool and to enhance the teaching learning process and to replace the teachers. Hence, a proper interfacing system must be provided in the classrooms that help the tutor to utilize the robot for the teaching process with a minimal training.

Fig. 7. Keeko Robot

In Yiswind Institute of Multicultural Education, Beijing, Greater China, the newly introduced robot named Keeko which is a roundish autonomous robot having a screen for the face and inbuilt cameras, and zips around on tiny wheels. This Keeko attracts the students of kinder gardens by means of telling stories to them and by improving their logical reasoning ability by the way of creating new logical challenges (Keeko, 2019) (The American Society for Mechanical Engineers, 2019) (The Hindu, 2018) (Phys.org, 2018) (The Conversation, 2019).

I. 3D Printing and 3D Printing Pens:
3D Printing is a technology used to build three dimensional physical model using layer wise manufacturing process. The required model is created as a 3D digital model using any of the available Computer Aided Design (CAD) software. Then it is converted into an STL file format (stereolithography) by which the CAD model is sliced in to thin layers. By using this data, 3D Printers build the solid models (Paresh Bheda, 2004). Among the different techniques, Fused Deposition Modeling (FDM) is a simple process used by the educational society because of its low cost.

3D Printed products can be used in the class rooms as concept models, to verify CAD database and styling, to conduct ergonomic studies and functional testing, and demo models, etc. Virtual prototyping provides greater freedom to the learners and teachers for building new parts and assemblies irrespective of their geometrical constraints and manufacturing limitations to understand the design concepts and functionality of the assemblies very clearly.

3D Printing Pens are doodlers capable of creating three dimensional drawings on air or surfaces. Peter Dilworth, Maxwell Bogue and Daniel Cowen of

WobbleWorks, Inc developed this 3D Printing Pens. This 3Doodler builds the three dimensional objects by extruding heated plastic (ABS material) that cools almost instantly into a solid, stable structure using the free hand movements.

Fig. 8. 3D Printer (FDM machine)

Fig. 9. 3D Printing Pen

By using this pen the teacher can create civil structures, mechanical components and assemblies, and any wireframe model or simple skeleton of three dimensional objects.

J. Other gadgets:
Google Assistant and Alexa from Amazon are the best gadgets that can be assist the learners to learn quickly and effectively.

Google Maps defines the location and provide quick or easy access to all the places with complete walk through supports and guidance with exact GPS values. Recently Virtual Positioning System is also introduced to facilitate the geographical learning.

Similarly, there are lots of online gadgets are available to enhance the teaching learning process such as online dictionaries, reference books, language translators, software programmers, and skill based online tests, etc.

III. CONCLUSION:
The famous BMW automobile manufacturer uses the AR technology to train their newly recruited employees to be skilled in servicing their cars. Some of the shopping malls introduced this AR technology for making amusement environment for the visitors. Online shopping process makes use of the VR technology for the size, colour, and pattern selection of fabrics for their customers. Digital transactions of funds using laptops and mobile components are commonly available facilities for even less valued services. Virtual surgery gives a good platform for the medical society to have simulated surgeries. Interactive Robots play an important role in almost all the places starting from canteens to airports. Due to the developments happening in the production of mobile phones makes everyone to go for high end gadgets and prefer smarter work. Hence, it is concluded that if all these developing digital based systems are used for teaching learning process, the outcome will be more fruitful and more beneficial to all stake holders. And this will lead to the evolution of new pedagogies that are smarter, flexible, easily accessible, not time bounded, and multi skill oriented, etc.

REFERENCES:
1. Natarajan R (2014), "Ithu Yarudaiya vagupparai (Whose Classroom is this?)", Books for Children, Chennai, India, pp. 28-35.

2. Anton Semenovich Makarenko (2004), "His Life and Work: Articles, Talks and Reminiscences Paperback", Foreign Languages Publishing House, Moscow.

3. Anton Semenovich Makarenko (1951), "The road to life an epic of education", [translated from the Russian by Ivy and Tatiana Litvinov], Moscow Progress Publishers, Moscow.

4. Eastern Peak (2016) How to creaate an App for your Business Available at: https://easternpeak.com/blog/how-to-create-an-app/ (accessed 04 January 2020).

5. Claudio Kirner (2018) Virtual and Increased Realit Available at: http://www.realidadevirtual.com.br (accessed 03 January 2020).

6. Adriana Soares Pereira, Liliana Maria Passerino, and Sandra Dutra Piovesan (2012), "Virtual Reality as a Tool in the Education', IADIS International Conference on Cognition and Exploratory Learning in Digital Age (CELDA 2012), pp. 295 - 298

7. Carl Nätterdal and Mustafa Hussein (2015), "The Benefits of Virtual Reality in Education - A Comparison Study", Bachelor of Science Thesis in Software Engineering and Management, , Department of Computer Science and Engineering, Chalmers University of Technology, University of Gothenburg, Göteborg, Sweden, June 2015.

8. Augment (2020) Augmeted Reality for Education Available at: https://www.augment.com/education/(accessed 03 January 2020).

9. Think Mobiles (2019) Augmented Reaity in Education Available at: https://thinkmobiles.com/ blog/ augmented-reality-education/ (accessed 26 December 2019).

10. DZone - AI Zone (2019) Augmented Reaity in Education Available at: https://dzone.com/articles/augmented-reality-in-education(accessed 27 December 2019).

11. Scholasatic Teachers (2019) Will the Kindle change the Education Available at: http://www.scholastic.com/browse/article.jsp?id=3752572(accessed 01 December 2019).

12. Kindle Education (2019) Mentor students to develop skills required to be successful in life Available at: https://www.kindleeducation.com/(accessed 01 December 2019).

13. ESL Fast (2019) A huge free online English learning resource Available at: https://www.eslfast.com/(accessed 03 December 2019).

14. Google Play (2019) Strenth of Materilas - SOM Available at: https://play.google.com/store/apps/details?id=com.faadooengineers.free_strengthofmaterials&hl=en (accessed 05 December 2019).

15. Ample Trails (2019) Steps create Online Moddles Exams Available at: https://ampletrails.com/steps-create-online-exams-moodle/e-learning-blog (accessed 08 December 2019).

16. Keeko (2019) (CNC) The Robot Teacher Available at: http://www.ikeeko.com/nd.jsp?id=18 (accessed 10 December 2019).

17. The American Society for Mechanical Engineers (2019) Robots Teachers Transform Education Available at: https://www.asme.org/engineering-topics/articles/robotics/robot-teachers-transform-education (accessed 10 December 2019).

18. The Hindu (2018) Robot Teachers in China's Kindergartens Available at: https://www.thehindu.com/sci-tech/technology/robot-teachers-in-chinas-kindergartens/article24812421.ece (accessed 15 December 2019).

19. Phys.org (2018) Robot Teachers invade Chinease Kindergartens Available at: https://phys.org/news/2018-08-robot-teachers-invade-chinese-kindergartens.htm (accessed 10 November 2019).

20. The Conversation (2019) Robots Likeky to be used in Class rooms as Learning Tools, Not Teachers Available at: http://theconversation.com/robots-likely-to-be-used-in-classrooms-as-learning-tools-not-teachers-66681 (accessed 08 September 2019).

21. Paresh Bheda (2004), "Rapid Prototyping in India – The journey so far", International Conference & Exhibition on Total Engineering, Analysis & Manufacturing Technologies (TEAMTECH 2004), 2004, pp.58