





Proceedings of STEC 2019 Sharing Teaching-Learning Experience Conference

Teaching Learning Center (TLC)

March 8th-9th, 2019 ABLT Complex

Indian Institute of Technology (BHU) Varanasi

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Concept Note

The Teaching Learning Cell (TLC) of IIT (BHU), under the Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT) scheme of the MHRD (Govt. of India), and in collaboration with the Inter University Center for Teacher Education (IUCTE, BHU) and the Faculty of Education of Banaras Hindu University, organized a national conference on **Sharing Teaching-Learning Experience** as a platform for the practitioners in higher education to share their teaching-learning expertise, experience and ideas in innovation, in the form of paper presentations, panel discussions and expert lectures.

The conference was organized to bring together scholars in higher education to share their teaching-learning experience and ideas on pedagogical innovation and application. The conference invited participation from the practitioners in teaching-learning across domains and disciplines (including innovation and experiences promising integration of school and higher education).

Research in education is happening at a greater pace than before, making it much more imperative to seek their harmonious integration in teaching and learning environment. A number of pedagogical innovations have led to an enlightened worldview on teaching-learning. Higher education, in particular, has higher scope for integration of these ideas into teaching-learning practice. The ideas, expertise and experience of the researchers and practitioners happen to be one of the most valuable among the sources for research and innovation in education. The conference aimed to bring them together at a common platform to facilitate a meeting of minds from diverse domains and disciplines to share their teaching-learning expertise and experiences. The sharing of wisdom enables a better understanding of the concepts and practices in teaching-learning leading to desired outcome. The conference was successful in bringing together experts from diverse disciplines who shared their pedagogical experiences in the form of keynote talks, oral and poster paper presentations.

The Conference included invited key-concept lectures, rounds of panel discussions (based on impact study and findings of PMMMNMTT schemes) and presentations, focusing on sharing of innovative ideas, expertise and experiences, from the faculty members, researchers and practitioners in the area of higher education from across domains and disciplines. In addition to papers sharing teaching-learning experiences, the Event also got participation reflecting implicational issues and innovations (including digital) with sustainability and other pedagogical and social concerns. Some of the major topics and issues that the conference witnessed during the two-day deliberation included:

- Academic roles and responsibilities
- Bridging the gap across self, society, institution and beyond
- Digital intervention in modes and modalities
- Educational innovation for sustainable design and deliverables
- Localization for the integration of teaching-learning research
- Impact study and findings from induction training programmes of PMMMNMTT scheme

Invited Speakers

Professor Sundar Sarukkai, NIAS, Bangalore Professor BK Tripathi, Director, IUCTE, BHU Professor RP Shukla, Dean, Faculty of Education, BHU Professor Pradeep Rao, Principal, MPC Gorakhpur Professor Alka Singh, Principal, VCW Rajghat Professor Rajani Singh, IIT (ISM) Dhanbad Professor Satya Sundar Sethy, IIT Madras Professor RK Mandal, Dept of Metallurgy, IIT (BHU)

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Organizing Committee

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Acknowledgement

Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT) scheme, MHRD, Govt. of India for financial support

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Citizen science as the new face of science communication and interdisciplinary milieu

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Abstract: We live in a post-truth world of post-normal science. People no more accept the scientific facts as tabled by the scientists for myriad reasons (which include but are not limited to the inability to grasp the technological details, disbelief to the data analytics and mistrust about the research intention). The scientists on the other hand are grappling with urgent decision making without evaluating long term effects. To compound the problem, science communication has also lost the sheen; neither is it reaching to general masses nor to researchers involved in different arena of study. Science communication is one of the most imperative but often overlooked subjects within the gamut of teaching-learning processes and it is time we address science communication through innovative windows.

Citizen science could be the way forward for science communication and would be instrumental in creating new inter-disciplinary avenues. It is probably the best pedagogy for life-long learning. A typical citizen science project could involve enthusiastic amateurs, professionals of similar or multidisciplinary backgrounds, volunteers of different strata and just about anyone - all of whom having a sense of belonging to that particular project. If properly executed, citizen science projects have the ability to take everyone at the same level of understanding within a minuscule time frame while path-breaking research can take years to enter into the textbooks. The data qualities generated from citizen science as well as the ability of the common public to participate in high-end research remain as the foremost criticisms of citizen science projects. However, with supportive mentoring and direction from established scientists and academics, citizen science could overcome these flaws and transform the knowledge-sharing platforms.

Keywords: Citizen Science, Science Communication, Public Engagement, Teaching-Learning Platform, Citizen Science Journalism

Introduction

Citizen Science is a part of Public Participation in Scientific Research (PPSR) and often termed as and/or overlaps with participatory science, crowd-sourcing, volunteer monitoring and other collaborative research which broadly deals with "public engagement in science" (Lewenstein, 2004). A citizen science project may include one or more lead researchers, a few moderators or trainers, regional supervisors and a gamut of volunteers with different level of expertise and interest. While the volunteer/community member helps to gather and document the related information the whole team can participate in interpretation and discussion thus demonstrating the public engagement in the project. The advantages of Citizen Science involve the collection of large-scale data across a diverse cultural and geographical span in limited time frame along with engagement with the public in subsequent decision making (Lewenstein, 2016). There have been discussions on limitations of citizen science projects involving the accuracy and completeness of the data, however, the quality of data collected by the amateurs are often as accurate as any trained researchers(Caren B. Cooper, 2014). Moreover, many Citizen Science projects involve moderators or researchers to screen and filter the information before the analysis is performed. In the past decade, a variety of Citizen Science projects in different disciplines and inter-disciplinary subjects have been undertaken worldwide. These include, but are not limited to, Astronomy, Environmental Science, Wildlife Biology, Artificial Intelligence, Neurosciences and linguistics.

Science Communication lies on the other hand of public engagement. The traditional 'top-down' way of science communication involved a one-sided approach of scientists or trained media professionals to update the common masses about recent research findings or at times filling the deficit (Bubela, 2009) (Illingworth & Prokop, 2017). However, in the post-truth world of post-normal science, the common public is often questioning the motif behind a finding and showing an increasing lack of trust for the same (Illingworth & Prokop, 2017), (Funtowicz & Rave, 1994). Despite the advancement in print and electronic media and science communication platforms, there is a chance that the findings are only being accessed by highly motivated individuals. The other challenges of science communication involve proper contextualisation of difficult topics, dealing with polarized views and reaching to the public of different educational, social and cultural level. An aversion towards science communication and scientific temper should not be a trend in general masses and avenues to tackle deficiencies in public engagement should be taken up.

It is in this context, citizen science can be at the forefront of science communication. Although citizen science has been termed as the "most dramatic development" in the field of science communication (Lewenstein, 2016), there has not been a concerted effort from the educationist and policymakers to include citizen science in educational, research or media framework. In a multi-lingual, multi-cultural country like India, science communication is more difficult to implement in the diverse setup, however, the flexibility and inter-disciplinary nature of citizen science projects can provide a reasonable solution for science communication.

Challenges of science communication in India

The science communication in India faces broadly four challenges: difficulty in conveying in local languages, the dearth of trained science communicators, lack of assessment of scientific temper and catering to a diverse audience.

The linguistic diversity of India poses challenges to communicate scientific knowledge in layman's language as the scientific language, full of jargons, is not a language of mass (Patairiya, 2016). The

cultural differences and non-existence of a uniform medium of communication (due to a diverse population speaking different languages and dialects) make conveying scientific knowledge to fulfill citizen's need a difficult task. Translating scientific knowledge related to public uses and services (such as agriculture, environment, food, sanitation,etc.) in local languages for the various medium of communication such as Radio and Television have been tried by state-sponsored programs of NCSTC, VigyanPrasar and NISCAIR(Mochahari, 2013). However, coverage of recent advances in the fields of science and technology is a rarity in regional language media outlets. Very few regional print and electronic media groups make an effort to popularize science.

Scientists around the globe and especially in India are primarily trained for performing scientific research and subsequentpublication thesis writing. However, very few educational institutes have programs on science communication strategies for research scholars or scientists. The same is true for media persons and media institutes. Science communication has emerged an academic discipline of study and professional practice in many countries but in India, science communication courses are non-functional at present. The failure to "produce the required manpower for science communication" probably stems from the fact that science communication is only followed as public outreach model conveying scientific results to the non-expert audience (Madhu, 2019).

Public opinion influences the public policy and importantly the funding for science and technology sector (Burstein, 2003). It is therefore vital to shape the attitudes of the public in ways that add to the progression of society in myriad forms. In recent times it has often been seen that people form opinions about scientific issues through the circulation of information in social networking platforms or through socio-political influencers and in many cases without verifying the fact. The science popularization and outreach activities that exist in a differentorganisation or media platforms are continued without assessing needs of citizens and their attitudes towards science and scientific issues. What is the impacts of these outreach activities on a national scale is still not known? Large scale research surveys like those conducted by National Science Foundation in the United States and Wellcome Trust in the United Kingdom on public attitudes and views on topics such as science, health and medical research are lacking in India (Khan, 2018). In fact, no large-scale continuous efforts have been initiated in this direction except the study of the public understanding of science in*Kumbh*(Raza, et al., 2000) and India Science Report(Shukla, 2005).

Understanding the publicattitude towards scientific and technological issues along with their socioeconomic background and educational statusis necessary for effective science communication. (Bultitude, 2011) Survey studies on public attitude and perception towards science classified population into different categories (Schäfer, et al., 2018). Such classification of Indian audience will be beneficial to develop a strategy for science communication with targeted audience i.e. policy makers, layperson, young researchers, innovators (Ganguly, 2018).

Citizen Science based model to Science communication

Science Communication has been practiced with different approaches and purposes which evolved with scientific and technological advancement. Science is not a pursuit which is carried in a vacuum; rather it is influenced by social, economic and political factors. As society becomes more multifaceted, the role of science communication in conveying technical and scientific information to

non-experts should co-evolve in a dialogue not just as a one-sided approach. Science communication has been studied at length in the past to advance its impact and understand the ways of effective communication. In the initial days of science communication, the deficit model dominated the thinking about effective science communication which was based on an approach to fill the knowledge gap. The problem with the deficit model was the belief that filling knowledge gap will ensure a better understanding of science by the public. Whether this scientific knowledge will be used by citizens and how it will lead to behavioural change- one of the goals of science communications was not addressed in this approach(Fischhoff, 2013). The science communication has now evolved from deficit to dialogue model (Trench, 2008). The need for two-way communication and establishing a dialogue between the scientific community and society initiated the other approaches of science communication with having the public in its core.

The shift from a deficit model to public understanding and engagement has been studied by scholars and many merits can be attributed to this public participation model. The focus on public engagement, advocacy of public participation in research is becoming more commonplace. Citizen Science or other orbits in PPSR are uniquemethodologies to establish collaborations for dialogues and practices among stakeholders of society. Citizen science gives an opportunity for non-experts to engage with researchers. The researchers in turn get equal opportunity to understand the nitty-gritty of scientific and technological aspects on society. The crucial element which needs to be highlighted is the intersection of various domains of knowledge with communication. Often communication has been seen as a separate part of research activity. This dichotomy has been limiting and therefore we need to envisage an environment of communication which needs to be recognised as the integral part of academic scholarship (Figure 1).



Figure. 1. An integrated Model of Science Communication coupled with Citizen Science. As the major focus of current science communication is on public participation, citizen science can engage the public in creating their interest and

subsequent knowledge-base while the public can be informed of policies and the implications.

However, voluntary participation in citizen science is mostly based on the interest of a person in a particular field. For example, a bird-watcher/birder may contribute to platforms like eBird while a star-gazer is likely to participate in SETI (search for extraterrestrial intelligence) projects. While the volunteers in both the platforms learn in depth about the field s/he may not be interested in each other's platform. This apparent stagnation of amateur researchers can be made productive channeling them a ina similar field of research design where the birder now document the whole biodiversity and the star-gazer contributes to analysing satellite images. The interest may not be there for a completely different field of study but a related field can generate almost equal attention. Similarly, an amateur citizen scientist can take part in several research projects and learn different subjects within a short span of time. Often it has been seen that citizen scientist take part in similar or even random projects and broaden their knowledge vista. If a similar approach is taken engaging people from different strata of the society in small to big, simple tocomplex research project, the science communication can surge ahead. Citizen science projects are often multi-disciplinary and a researcher will learn about different fields of studies too. Participating in an inter-disciplinary project requires attention to different knowledge-base and it in turn can give rise to new subject specialities. Continuous participation in different citizen science project will lead to absorption of scientific culture and perception.

Future prospects of Citizen Science and Science Communication

The mode of action of citizen science projects although universal could vary from country to country. It is in this regard language and cultural barrier and acceptance could play an important part. The problem in science communication in local languages has often been discussed at length. The participant in a citizen science project can break the language and cultural barrier by engaging with other participants from the same language and cultural tradition.

On the other hand, a citizen science project also helps in enabling a researcher to mature into a mentor or trainer. These projects are not only based on imparting knowledge or gathering data rather the conversation between the instructor and the participant enables the researchers/moderators aware about the limitation of the study as well as how to take all participant along in the same level. These practices will help the researchers designing better projects in the future and also have better output from a diverse participant group.

Science communication needs audiences as much as it needs a platform or media. The current educational system needs more polishing to create a sustainable audience base. Citizen science can impart science communication in a viable and continuous fashion. Incorporating a citizen science project in the coursework will inculcate the scientific temper and meticulousness in a student. The project can be chosen taking into account the educational level of the student and the course s/he is

pursuing. Citizen science projects could be asupport if not standard practices for practical or hands-on activities. The advent of the internet and advantage of online forums have made a real-time discussion from a different part of the world feasible. It has also increased sharing and storage of data in a common platform worldwide with accessibility to the users' day in and day out.

Internet and media technology have broadened the vista of science communication and at the same time gave new opportunity to practice citizen science as a methodology for scientific research. Growing penetration of internet is related to the accessibility of digital platforms and information. Internet-based media has opened the environment for everyone – scientists, a young researcher, policymaker, and common citizen to write and tell their stories. This practice of 'we the media' evolved with a term Citizen Journalism. Citizen Journalists are the people at a grassroots level who have first time interaction with the events and places. Science when used in society as nuclear power or genetic engineering it is not only the scientific experiment performed in the laboratory. The ground realities may differ from raising serious issues at the intersection of science and society. These issues may be brought by citizen science journalism in the context of science, it is important to explore the utilization of 'citizen' as local communicator who serves as a connection between a segment of society to larger media and scientific community as a citizen science journalist; a resource who can participate in a scientific research to produce valuable data as a citizen scientist.

Conclusion

Citizen science is public participation in science – involvement of the community in combined research. It can be pursued in any field of study – whether it is humanities and social science or natural science or of a multi-disciplinary nature by anyone anywhere in the world. Citizen Science, often considered as a methodology to collect large scale data or approach to the particular type of projects, can become a mode of education to produce interdisciplinary knowledge required for issues at the intersection of science and society, technology and society and environment and society. It can provide an opportunity for young students and researchers to think beyond disciplinary boundaries. Educational institutes can also utilisea citizen science project to create interest among the students and generate future researchers. The guidelines in the project forum and the mentoring by forum moderators and senior researchers often prepare students to learn the rules and regulations and proper research methodologies. A student may not show much interest in a research project where s/he is interested.

Science communication if imbibed through citizen science can transform different strata of society. Not only it can lead to the creation of serious researchers, but it can also create future science communicators. A person interested in a field of study may take up writing about the same in different print and electronic media and even start a citizen science project of her/his own. Science communication, even with print and electronic media platforms are often lop-sided in that a person may learn about a recent finding and then forget the same in subsequent days or weeks. However, a

citizen scientist will learn about the past and present research during the project and in the aftermath will be interested in continuous knowledge gathering from different sources. A successful citizen science project thus can gather more information than that is possible for a single researcher to assemble in her/his lifetime.

Conflict of Interest and Acknowledgement

The authors declare no conflict of interest. We thank Dr. Raoof Mir for critical evaluation of the manuscript.

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Filling Gaps in Science Teaching in Schools: Our Experiment and Experiences

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Abstract

The present curriculum for science subjects in classes 10-12th is highly enriched with vast and indepth concepts that expand into university curriculum with matching experiments. Though most of the experiments devised are well intended, but lack basic knowledge of understanding on how to perform the same. Though students who pass out of 12th and enter the university may have theoretical background, still they cannot correlate their theoretical knowledge with experimental verification. Such a system does not fulfil the objective of enriching school science with recent and updated research outcomes to motivate students and prepare them for higher dimensions of scientific pursuit. While this is one face of the coin, another face is a more confused state of students, who are not exposed to experimental environment, where such improved theoretical background is more problematic. Such students cannot decipher the even basic apparatus or glassware, leave alone the experimental outcome. In such a scenario, a workshop had been envisioned and organized successfully in Mahila Mahavidyalaya, jointly with School of Education, Faculty of Education, BHU under PMMMNMTT scheme of MHRD, for school teachers. The objective was to help the teachers who are stuck up at overcoming basic difficulties and also to brief them of new experiments to enrich the existing school syllabi and take it to the class room. The details of conducting such workshop and lessons learnt are detailed.

Key words: Bridging the gap, School science curriculum, Science experiments

Introduction

Teaching of science subjects in classes 10-12th has been revised over the years with vast and in-depth concepts as per the recent developments in basic and applied sciences that expand into university curriculum with matching experiments. Though most of the experiments devised are well, but the basic knowledge of understanding, on how to perform the same is lacking among the school teachers. Therefore we decided to organise a workshop as an attempt towards fulfilling the social responsibility of the University, thus bridging the school education with higher education. The theme of the workshop was to give hands on training to school teachers involved in science teaching so that they can get well acquainted with the recent advances in science techniques and enlighten the young brain.

The workshop was aimed to provide a new opportunity to the teachers as it covered the various areas in both life science and physical science with hands on training.

Motivation for the workshop

The need for organising such a workshop came from the experience we had in teaching the students who were admitted in UG courses in the university. Most of the students admitted didn't have the basic idea of a science lab, the instruments and glassware. The expected scientific level of an intermediate student was lacking which also made the UG teaching tough. Looking into the problem for quite a long, we found that the revised syllabi of the schools are not being met at the school level, as many schools teachers who have been admitted long back have themselves never performed the experiments upgraded in the syllabi. This motivated us to organise a workshop for school teachers to overcome the fundamental barrier as syllabi reforms requires significant upgradation in teacher's knowledge as well. Confucius once said in the ancient Chinese proverb "I hear and I forget, I see and I remember, I do and I understand". Thus hands on training activities in science support the development of practical skills and help to shape and understand scientific concept and phenomenon. We therefore thought of providing a platform to the school teachers nearby the university who were in service and dealing with science teaching at 10+2 level.

Upgradation of syllabus and its associated problems

According to Sarangapani 2014, School science teaching is exposed to three main challenges: Unavailability of proper labs and equipments while teaching science; Shortage of science teachers and elementary school teachers who have been educated in science at least up to class 12th; and what should be included in science curriculum that should address itself constructively. Kaptan and Timurlenk 2012 have also indicated several problems associated with science teaching, few of them to be mentioned here are insufficient laboratory facilities, intensive curriculum but insufficient time and passive mode of teaching science. Strengthening of science education is the most important challenge faced while designing a curriculum. Major concern of research is towards secondary school teaching while primary education also identifies similar issues. Science education is of great importance to citizens in several ways such as to inculcate healthy life style, proper civic sense and for economic lives. Thus a curriculum must be such that it matches the purpose of "science education for citizenship".

Practical's form integral part of teaching and learning in science. It is necessary for the enhancement of scientific concepts, skills and values in learners and enhances their performance in science (Malathi and Rohini, 2015). We can understand that availability of labs and experiments are the major concerns

of science syllabus framework. Science teachers are required to organise their teaching in a different manner which needs planning and execution of experiments in limited available time period (Kelly, 2018). Many labs cannot be completed in less than 50 minutes as per the CBSE time frame for an experiment, so science teachers are often compelled to divide the stages of an experiment over couple of days. This may not be possible at times when dealing with chemical reactions. Some science equipments costs lot of money and budget concerns limit teachers from doing certain labs. Performing an experiment needs skill that cannot be gained by watching video as practised in some schools. Even if any teacher wishes to conduct an experiment for the class room, the methodology described in text books may not give information to decipher the content in between the written lines. Many experiments may not work out as described in the books. To make the systems workout, one needs to address the challenges that are arising. Research is required to establish clear links between curriculum goals and its fulfilment in an economical way so that it reaches to maximum schools irrespective of its physical state.

Framework

The workshop was framed to cover the recent advancements in science syllabi through lectures given by eminent scientists of the university. The participants were asked to put their doubts in science topic right in the application form, so that it could be addressed during the workshop. Each lecture was followed by a discussion session so that the participants could get a space to interact and clear their doubts. The participants were also informed on how to carry on the research to the young minds in classrooms through simple projects and models. Each day the lecture was followed by hands on training in which each participant performed the science experiments individually under the guidance of university faculty so that they could have a command over the actual problems coming in performing any practical (Fig1). During practical's care was also taken to inform them on how to initiate the things from scratch till results in a classroom. This greatly helped the teachers not only in updating themselves but also in conducting experiments in a cost effective manner as many of them were often cheated by the chemical suppliers by providing poor quality consumables at high price. To quote an example: few experiments in Botany could be performed easily by taking fresh samples from the garden which otherwise was procured by the school teachers at high price under limited budget. During hands on training, attention was also paid on performing the experiments which the school teachers found difficult to carryout for years. This actually made the learning process exciting. To make the teaching learning process easy and effective, all the school teachers were provided with a manual of the experiments performed during the workshop made by the organisers. This manual provided complete information starting from chemical requirements, reagent preparations, basic concepts and procedures. A holistic approach to address their doubts was highly appreciated by the fraternity.

The teachers were also suggested to enrich their labs by plant and animal samples by encouraging the students to help in this process during their school and family visits.



Fig 1: School teachers performing experiments during the workshop

Limitations in execution

The foremost difficulty faced during execution was that interested school teachers were not relieved by the school authority. The biggest challenge was to convince the Principals of the school that it was not the conventional workshop dealing with teaching methodologies, but rather hands on training in science experiments with respect to the upgraded syllabus in science. As argued by the Principals, attending such workshops not being a part of their school curricula, it is not important for their teachers to attend.

As the universities and schools both have their own academic calendar, therefore finding a suitable period to conveniently run the programme for 1 week was also a concern. The university labs are mostly engaged with UG and PG practicals throughout the year. Full support from the University lab staff is also required in conducting the experiments in labs as every experiment requires a lot of prior preparation.

Financial constraints in performing molecular experiments were also faced as all such experiments require costly chemicals and enzymes. Hence few of the practicals were demonstrated to the participants so that they could understand the basic theory and can address the queries of the student in the classrooms.

Feedback by the participants

Participants learned the basic practicals in science which should be conducted in the schools. Simple practicals which could be easily performed were also not conducted in schools due to lack of experimental design. According to the comments of the participants most of the experiments were demonstrated in a very simplified manner consuming very short time which was a new learning to them. The participants were excited about how school level science experiments could be demonstrated using inexpensive and easily available materials (Fig 2). Many teachers felt that more workshops like these should be organized periodically so that more teachers could be trained for effective teaching. Few participants were of the view that several such workshops should be organised but for short duration of about 3 to 4 days and also should be subject specific. This would help them in getting official leave from their schools, though theoretical science teaching was very good however, regarding practicals, the level of science was not met due to heavy student strength and lack of proper knowledge in resource utilization. So such kind of training could help them in improving the situations at schools. Private schools having low strength of students and well-developed infrastructure feel that they could easily implement the knowledge of workshop among the students.

Feedback PARTICIPANT FEEDBACK FORM Dharni Dhar Chaturvedi **PGT-Physics** Central Hindu School (Boys) Kamachchha, Varanasi Excellently structured and very notivating covered a lot of ground. susions are taught by experienced teachers. The hands on pocaetical training sessions were very good. Thank you to eve ody involved

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Follow up programs

Follow up activities are a part of the process of external quality assurance of any study programme which are designed to access the success of the activities being held or performed. Although follow up part was not the regular part of the workshop but assistance was provided by the workshop organisers whenever requested by the school teachers. Since the aim of the workshop was to enlighten the schools with the recent scientific experiments, follow up activity is required to observe whether the taught part has been successfully incorporated. As a follow up of the workshop, several resource persons are regularly clarifying the doubts of the school teachers in overcoming the difficulties. At times, on request they're visiting the schools and really looking into the problem and suggesting means to overcome them. We have found that govt. schools need more infrastructures with more trained teacher for generating the interest in science among students. Excess student strength in government school is a challenge to science teaching. As some school teachers feel that student have great enthusiasm for learning science however, lack of experimental knowledge and complexity, teachers are not able to implement practical's thoroughly. Thus, there is utmost need to educate science teachers for uplifting the education in government schools.

Outcome of the workshop

The non-conventional idea of the teaching learning process through hands on training in science practical's proved to be a great success. The participants were benefitted from the following after successfully taking part in the workshop.

- Confidently performing experiments to suit the needs of the syllabi within existing resources
- Frame experiments to suit the existing resources.
- Overcome the existent difficulties in performing experiments, which do not work out as described in standard procedures.

Besides this, when performed on their own, the students will get clarity of the principles involved. Such an exposure generates/increases their passion towards science. Even if they do not adhere to science learning further, the training gives them an exposure to apply or understand scientific principles in daily life which is quite required for a healthy society.

The workshop also opened a door to the schools nearby the University to feel free to contact the University faculty as and when needed. A holistic approach to address the doubts in science through lectures, experiments and providing manuals made the workshop memorable to the participants.

Suggestions

The conducted workshop was a maiden attempt to bridge the gap between school and higher education in sciences. With the experience of conducting the workshop, following changes may be considered for incorporation in future workshops to derive maximum benefit.

- To have subject specific training covering more number of experiments. Such a program helps to learn more experiments and devise new ones by sharing the knowledge and understanding problems under diverse situations.
- A visit of limited number of students to science labs of host institute, considering the limitations of time, space and expenditure involved

Such a visit will mostly benefit the students from remote areas when they're exposed to scientific atmosphere and sow the seeds of scientific temperament.

- A more comprehensive workshop for mid-school students.
- A major step forward will be when attending these kinds of workshops are made mandatory for science teachers as per NCERT/ CBSE guidelines to refresh their knowledge periodically.

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Observational Study and Findings of Month Long Induction Training Program of TLC, TU Under PMMMNMTT Scheme

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Abstract: In higher education, development of multiple skills among teachers is central to the issues of quality and excellence. As per the recommendation of GoS, MHRD, GoI, Teaching Learning Centre, Tezpur University has implemented Induction Training of Faculty since 2017. Till now the Centre has completed 3 such Training Programs. This study covers impact of the programs in order to orient them on various aspects of teaching and learning. Findings are based on participants' feedback and objective of the content. Overall it has been observed that month long Induction Training Programs have improved the professional capabilities and performance of the young teachers of Higher Education in delivering effective teaching and learning.

Keywords: Induction, professional development, content framework, teaching and learning

Introduction

Induction training for beginning teachers is an important process in acculturating teachers to their new profession. The transformation to a learning community is the purpose of an effective on-going induction program not only designed to relieve the stress of early career teachers, but also to acculturate that teacher into an organization that is focused on professional learning and quality. In higher education system of present times, it mainly focuses on subject specific knowledge of the faculty. It does not focus on teaching learning process, pedagogical contents and the tools that are very vital to increase the quality of learning experience in the different educational programs.

Traditional methods of lecturing do not meet the demands of the dissemination of knowledge in classrooms effectively in today's scenario, where Outcome Based Education and Learner-Centered Teaching are the order of the day. Emergence of ICT tools and their usage in Teaching-Learning process has been redefining the role of a teacher from a mere provider of information to a facilitator of learning concurrent to current trends. Further, despite becoming experienced in teaching, the teachers are not able to contribute significantly to the academic administration and the overall development of their institutes due to lack of (i) awareness of the administrative structure, policies and governance of their institutes, (ii) knowledge on roles and responsibilities of teachers, (iii) training in student-counselling and (iv) scope for empowerment and academic leadership. Therefore, there is a need for newly recruited teachers in Higher Education to undergo training in modern methods of teaching and evaluation before they start teaching any course. Further, they must be familiarized with different roles and responsibilities of a faculty member in Higher Education in order to perform their duties effectively both in academics and administration. Keeping in view the necessities, Teaching Learning Centre, Tezpur University (TLC, TU) has implemented the Induction Training of Faculty (ITF) by following the instruction and content guidelines prepared by Group of Secretaries, Dept. of Higher Education, Ministry of Human Resource Development. The main objectives of the Program are:

- To make the participants know the structure, functioning, governance, rules and regulations in Institutions of Higher Education and to orient them to become potential partners in institute building
- To enable the faculty to understand their roles and responsibilities in Higher Education and to impart essential professional skills, competencies and attitudes
- To enable the faculty to conceptualize the nuances of curriculum design and development in higher education at global standards.
- To train the participants in modern teaching methods and strategies
- To train the faculty members on the use of ICT tools and integration of ICT in teaching and research
- To train the participants in methods of evaluation and assessment of diversified groups of students
- To provide research orientation to young faculty towards integrating research with pedagogy
- To develop practical knowledge in emotional balance of self and in student-counselling and mentoring
- To enable the faculty to generate new learning materials for enrichment of online open access platforms
- To provide knowledge about different models of leadership to the participants in order to enhance their academic leadership skills
- To enable the faculty to learn the principles of strategic planning and management

Implementation of ITF in TLC, TU

Teaching Learning Centre, Tezpur University has implemented the program in June, 2017. The first batch of faculty members were inducted in its month long training during 23 November and 22 December, 2017. The second batch of teachers were inducted during 06 June and 05 July, 2018 with total 40 number of registration. The third of the training program was conducted with 26 teachers during 26 November and 26 December, 2018. It has followed carefully designed modules and their subtopics from the content guidelines.

Objective

The objectives of this study are:

- to find out the implication of the content framework of Induction Training of Faculty.
- to find out the perspective of Induction Training of Faculty from participants' point of view.

Criterion of Inputs

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In this observational study, a program schedule has been prepared from the Modules that have been taken from the content framework for Induction Training of Faculty in Universities/ Colleges/ Institutes provided by MHRD, GoI. Keeping in view the different modules of the content framework, eminent resource persons are invited from Universities and Academic Institutions to take part in technical sessions. Social activist, Entrepreneurs and Renowned Persons were also invited to motivate and deliver speech. Most of the participants were from Academic Institutions of North-Eastern Region, although it is open for participants across all over India. Applications are invited from faculty members through Tezpur University website in online mode.

Discussion

In the content framework it is mentioned that in the one-month duration program, all core courses may be covered and in the full 3 month long program both core & elective courses and some field visits and project work may be included. In the case of the ITF conducted by TLC, TU both the core and elective courses were included. The following are the core courses under which some select subtopics were covered for comprehensive discussion and interaction with the participants.

Module 1	Covered sub-topics
Roles and Responsibilities of	• Evolution of the Higher Education sector of
a Faculty/Academics in	India
Higher Education	 Understanding Roles and responsibilities
	• The University Act and Legislation
	• Education reforms of the 21st century

Invited experts and resource persons discussed about traditional role of teachers as facilitators of learning. The role of teacher had been changed to transmission of intellectual tradition. Role of teacher can be emphasized on the basis of three main themes and these are i) Traditional role of a teacher, ii) Teacher's role today and iii) Teacher's role in developed nations. According to them teacher should create condition that learning could take place along with personal goal with social responsibility or social justice. In the same context professionalism and ethics had also been discussed.

Module		Covered sub-topics						
2								
University		• National Academic Governance, Communication	and					
Structure	and	Accreditation						
Functioning		University Structures						
		University Officers						
		College Structure and Administration						

Here the participants were taught about administration of higher education along with mandates, authorities of higher education institutes, academic officers and their power and functions. It also encompassed sustainability of funding and governance, function, roles and mandate of UGC, inter university centres etc.

Module 4	Covered sub-topics
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Pedagogic Techniques	• Changing definition of pedagogy and constructive			
& Teaching and	methodology			
Learning Methods	• Inclusive approaches of teaching and learning			
	 Micro teaching & Skills of teaching 			

Basically it included discussion and activity on what teaching skill is and its importance along with different types of teaching skills namely presentation skills & different strategies to adopt it, communication skill, problem solving skill, questioning skill, summing up skill, classroom management skill and interpersonal skill. The importance of learning student psychology and their cognition of learning being its central point. It also highlighted that it is a theory based on observation and scientific study that how people learn which says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on experiences.

Module 5		Covered sub-topics					
Assessment	and	• Difference between assessment	and				
Evaluation		evaluation					
		 Levels and framing of questioning 					
		• Evaluative criteria for assessment					

This module consists of interactive discussions on Choice Based Credit System and about the importance of CBCS, various problems and some of advantages of the system, sequence of evaluation, qualities of a good question with examples and a balanced question paper. There are also included discussions about evaluating of an answer script with respect to different scales of measurements.

Module 8				Covered sub-topics				
ICT:	Effective	Use of		• ICT based teaching methods				
Technology for Teaching,		ing,	• Role of ICT tools in teaching and					
Learning and Evaluation			learning					
				• ICT based assessment methods				

The main emphasis of this module is on Online Teaching Learning assessment with Open Educational resources, Educational Technology Tools & free Open Source MOOC Delivered Platform. During the sessions discussion about SWAYAM and MOOCs and it also talked about SWAYAM Prabha, National Digital Library of India, e-shodh Sindhu, blended classroom and online classroom. There were demonstrators on how to create MOOCs. The beginning teachers were given hands on training on use of the different softwares for creation of screencasting videos.

Module	Covered sub-topics							
11								
Academic Leadership	• Key strategies and skills for effective							
	leadership							
	Administrative leadership							

This module aimed at getting acquainted with the traits of leader, situational leadership and different ways of assessing staff. There is an excellence in our objective and how to promote excellence in higher education institutes. It also included the role of academic institutions in getting ranking of universities, NAAC, Grading, NBA, Accreditation where academic leadership play a very crucial role. It discussed about problems or factors which create hurdles in excellence like resource crunch, limited excess, problem of equity, lack of quality and autonomy-academic. Status of higher education in India, world's ancient institutes of higher education were also depending on leadership qualities of individuals.

The elective modules were also given some importance on account of lecture, demonstration, interaction and shared activities. These elective modules are as follows:

Module 3: Curriculum Design and Content Development Module 6: Research in Higher Education Module 7: Personal-Emotional Development and Counselling Module 9: E-Content Development & MOOCs Module 10: University Governance and Administration Module 12: Strategic Planning and Management

Observation and Findings

Observation from ITF I: First Induction Training of Faculty was held during 23 November to 22 December, 2017. Altogether 26 faculty members of various disciplines participated in the program. Among them 14 participants were from Humanities, 8 from Science, 2 each from Commerce and Engineering. There were 10 men participants and 16 women participants in the program. The content of the program was prepared according to the guidelines of MHRD that cover different topics related to Higher Education. 47 Resource Persons from different disciplines (Science, Management, Engineering, Humanities and Social sciences), shared their rich experiences and insights about being good, effective and motivating teachers who are custodians of values and culture of a society. The program also tried to cover some activity like practice teaching, group discussion and presentation. Every day two sessions were held before lunch and two sessions after lunch where each of the session duration was 90 minutes. In the last week of the program an examination was conducted based on objective type (MCQ) questions provided by respective resource persons.

Participants were taken out to field visit to appreciate rural life, cultivation and mighty river Brahmaputra. Feedback for each Resource Person was taken separately in online mode. Also an overall feedback of the program has been taken from the participants. According to them program management, communication and hospitality were very well managed. Regarding the suggestion of improvement of the content of the training program, participants suggested more interactive and learner centric sessions. Their suggestions were carried forward to the next Induction Program.

Observation from ITF II: Second month long Induction Training of Faculty was organized by Teaching Learning Centre (TLC), Tezpur University during June 06 and July 05, 2018. Altogether 40 faculty members of various disciplines from different academic institutions from Assam and

Arunachal Pradesh participated in the program. Among them 18 participants were from Humanities, 12 from Science, 1 from Management and9 from Engineering. There were 25 men participants and 15 women participants in the program. The content of the program was prepared according to the guidelines of MHRD that cover different topics related to Higher Education. 51 Resource Persons consisting of Academic Administrators (Vice Chancellors and Registrar), Academicians from different disciplines (Science, Management, Engineering, Humanities and Social sciences), Social Activists and Fitness Experts shared rich experiences. The program also included some activity like use of screen casting, creating e-resource support, use of google classroom, google form, practice teaching, group discussion, movie review and presentation. Feedback for each resource person was taken separately in online mode along with overall feedback of the program. In the last week of the program an examination was conducted based on objective type questions provided by respective resource persons. There were 4 academic sessions in each day.

Observation from ITF III: Third Induction Training of Faculty was held during November 26 to December 26, 2018. Altogether 25 faculty members of various disciplines from different academic institutions participated in the program. Among them 11 participants were from Humanities, 4 from Science and 10 from Engineering background. There were 14 men participants and 11 women participants in the program. The content of the program was prepared according to the guidelines of MHRD that cover different topics related to Higher Education. 48 Resource Persons consisting of Academic Administrators (Vice Chancellors and Registrar), Academicians from different disciplines (Science, Management, Engineering, Humanities and Social sciences), Social Activists and Fitness Experts shared rich experiences and insights about being good, effective, motivating teachers who are custodians of values and culture of a society as well as change agents, role model, society and nation building, administrative aspects including procedures and rules. The program also tried to cover some ICT activity, e-resources, google classroom, google form, practice teaching, group discussion, presentation, movie review and field visit. Feedback for each resource person was taken separately in online mode & an overall feedback. In the last week of the program an examination was conducted based on objective type (MCQ) questions provided by respective resource persons. There were 4 academic sessions each of 90 minutes duration in each day. Summary of participants and resource person of all the three ITF is given in Table 1. Highlights of some interactions and activities are given in Appendix.

Graphical representation of some of the indicators of feedback

In the overall feedback form some questions have been given to the participants to observe their views regarding content, preparation and implementation of the schedule. Summary of their responses are graphically represented. Figure 1, 2 & 3 represent the perception of the schedule.

Responses regarding usefulness of group work (Figure 4) observe that group works are very useful for them as more than 50% gave their responses supporting very useful. Also participants acknowledged that they acquired new knowledge through the discussions in the training program (Figure 5). Most of the participants like to recommend the training program to other faculty members (Figure 6).

On the basis of their responses it can be said that content is overall good and at per their expectation. Number of lecture and group works are also fine and fairly useful. They also acknowledge that they acquired new knowledge and the program is recommendable to other faculty members. After getting feedback regarding expectations from the first ITF, in the next 2 ITF some relevant topics were included though these were not prescribed in the original framework. These additional topics are –

- Creativity in Higher Education
- Mother Tongue vs Second Language in Teaching Learning
- Teaching Learning Techniques using Role Play
- Integration of Cultural Elements in Teaching Learning
- Challenges ahead Social Sciences
- Indigenous Knowledge System
- Teaching and Motivation
- Society, Local Culture & Heritage
- Entrepreneurship and Skill Development.

From second round of ITF assignment on use of ICT were given as it makes learning more attractive. Generation of e-resources suggested in different disciplines of the participants has been uploaded in Centre website. Participants were also asked to prepar video resources of their own domain using screen recording tools. It has been observed that in all the 3 month-long induction programs invited talk, delivered speech, discussion, presentation, activity, review work and field visit have been included in the schedule. At the end of each program participant's feedback and recommendations were received and moderate changes were made in the content of second and third induction program.

The study has found out some of hurdles to meet the goals of the training program. These are:

- Some contents are repeated University act and statutes (Module I and Module II)
- Some contents are not up-to-date Pedagogic techniques and teaching learning methods (Module IV) modern methods are not focused like cognitive psychology.
- Some contents/areas are not clearly defined or self explanatory (Module V) Objectification of the subjective aspects of learning for better assessment.
- Though suggested readings are provided, the list is not exhaustive. Even some of the suggested readings/contents are not available or only partially available.
- Taking attention of multidisciplinary participants in a particular topic like research methodology or similar kind.
- Faculty members unable to arrange duty leave on time / for the entire period of the program due to lack of supporting staff in the same department.
- To arrange additional responsibilities while on duty leave is found to be distracting or disruptive for the training.

Summary

Overall, the Induction Training Programs have improved personal as well as intellectual development of young faculty members of Higher Education. Teacher induction program play a pivotal role in the period of transition from student to teacher. Besides other possible effects, good induction programs are, above all, assumed to contribute to teacher's well-being and their professional development. Good induction program, therefore, are of values not only for teachers, but also for students.

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Appendix

Table 1Summary of participants and resource person of all the three ITF.

No. of Participants						No. of Resource Person	
Gender		Discipline		Category		-	
Male	49	Humanities	43	General	38	Academic Administrators	26
Female	42	Science	24	OBC	26	Academicians	112
Total	91	Engineering	21	SC	9	Social Activist	3
		Management & Commerce	3	ST	18	Fitness Experts	5
		Total	91	Total	91	Total	146

Figure 1: Responses for content of the program Figure 3: Responses for amount of group work Figure 5: Responses for acquired new knowledge others Figure 2: Responses for number of lectures Figure 4: Responses for rating of group work Figure 6: Responses for recommend to









Student's perception of relevance of seminar-based pedagogy in the coursework of doctoral programme in management

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Abstract:Seminar-based pedagogy is extensively used in the coursework of the doctoral programme (Malfroy, 2005) and more so in management. Therefore, it is reasonable to assess the relevance of this pedagogy from the students' perspective at this stage. Three management institutes from prestigious Indian Institutes of Management (IIMs)inAhmedabad, Indore, and Raipurwere selected for the study. Online open-ended questionnaireswere administered on 19 students of these IIMs and data so collected were analysed based on the thematic analysis. Results indicated that seminar-based pedagogy could not be all-purpose pedagogy for all kinds of courses. Students perceived seminarbased pedagogy as appropriate and useful in case of their respective area courses. Non-area specific courses and courses based on research methodologies including statistics were in general perceived to be not relevant with seminar-based pedagogy.

Keywords: Coursework in doctoral programmes, Seminar-based pedagogy, Area specific coursework, Non-area specific coursework, General methodology coursework.

Introduction

Coursework has been one of the essential components of any doctoral programmes. Coursework is considered as a critical programmatic phase of a doctoral programme which helps students socialise through integrating with their peer groups and assistantships (Gardner, 2008; Pervan, Blackman, Sloan, Wallace, Vocino & Byrne, 2016). However, Gardner (2008) stated that given the objective of the doctoral programme which emphasises on developing students as an independent researcher the socialisation process in such programmes differs significantly with the socialisation process of these students in their previous academic settings. Thus, the socialisation environment provided during the coursework of such doctoral students also quite differs from the regular classroom that these students had experienced in their longer educational backgrounds before attending the doctoral programme.

One such aspect of differencesis pedagogy used in the coursework of doctoral programmes. While postgraduate courses specifically in management are increasingly using the case-based teaching pedagogy (major institutes of management including IIMs in India), there has been a rise in the usage of research seminars as a pedagogy used in the coursework of doctoral programmes (Malfroy, 2005). So far research has given more prominence to student-supervisor relations (Malfroy, 2005; Lee & Green, 1998), overall socialization process of a research student (Gardner, 2008), differences between professional and core doctoral programmes (Malfroy, 2005; Evans, Macauley, Pearson, & Tregenza, 2005; Neumann, 2005; Wallace, Byrne, Vocino, Sloan, Pervan, & Blackman, 2015), and student's experiences of the entire doctoral programme journey (ACER, 1999). Thus, past researches have majorly focused on the overall components of doctoral programmes in totality, and specific study on a particular component of doctoral programmes such as coursework based on seminar-based pedagogy has been barely attempted.

Given the objective and role of coursework in terms of socialising research students (Gardner, 2008), introducing the basics of research, and developing students into an independent researcher (Gardner, 2008), how far seminar-based pedagogy succeeds remains to be examined. Literature reveals that so far assessment of pedagogy used in the coursework a doctoral programme had mainly been ignored at least in India. Even the scales developed to measure research experience of students and the outcomes achieved by students enrolled in doctoral or higher degree programmes, i.e., Postgraduate Experience Questionnaire (PREQ) (ACER, 1999) did not include coursework as one part of subscales out of the total six subscales it initially encompasses. Similarly, it was difficult to find any studies which focused on the relevance of seminar-based pedagogy in general and its usage in doctoral programmes of management in particular. Therefore, there exists a growing need for the overall understanding of the following issues;

- The extent to which seminar-based pedagogy is used in the coursework of the doctoral programmes in management.
- The relevance of seminar-based pedagogy in terms of its appropriateness and usefulness of such courses as per student's perceptions
- General speculation suggests that seminar-based pedagogy cannot be an answer to all kind of courses in such programmes. Therefore an understanding of kinds of courses that are deemed relevant by students to be delivered through seminar-based pedagogy.

The current study attempts to explore the above issues in the context of doctoral programmes in management offered by various IIMs in India. The paper will commence with the review of related but scantly available literature in the area. It will then briefly explain the methodology used to collect data. Subsequently, it will discuss the brief results of the data using thematic analysis. Next, in the discussion

section, the theoretical and practical implications of the paper will be argued before finally deliberating the recommendations for future research directions.

Literature Review

Doctoral programmes, in general, are nurseries of future university/institute professors. Shulman (2005) stated that if one needs to understand the typical characteristics of a profession, one should visit their nurseries, i.e., their forms of professional preparation. Nurseries are the places where we can observe the kind of pedagogy used to inculcate required skills to aspirants of a particular profession. There had been professions which can be traced based on effective pedagogies used by their respective nurseries. These pedagogies are called signature pedagogies (Shulman, 2005); for example, the quasi-Socratic interaction in law is one such signature pedagogy in the field of law.

The professional development that doctoral programmes aimis to prepare students to accomplish not just the degree but also to make them responsible enough to serve the field of their programme through grooming future students and research endeavours.Signature pedagogies play an essential role in shaping the character of future practice and in symbolising the values and hopes of the professions (Sulman, 2005; p.53). Does the field of management also hold any specific signature pedagogy which influences the overall management profession is beyond the objectives of the current study?However, there has been scantly available evidence that seminar-based pedagogy has been used extensively in the coursework of a doctoral programme in management (Malfroy, 2005). Thus, the question arises whether seminar-based pedagogy has the potential to affect the entire character of a student as a future academician.

Seminar-based Pedagogy: Seminar is a small group teaching-learning (T-L) session in which the participants discuss under the guidance of an expert (Palappallil, Sushama, & Ramnath, 2016). Seminar-based pedagogy might not hold the status of signature pedagogy for management academicians presently though argument in favour of seminar-based pedagogy can be developed based on the various dimensions of signature pedagogy as given by Shulman (2005). These dimensions include surface structure (operational acts of teaching and learning), deep structure (how best to impart knowledge) and implicit structure (moral dimension). Seminar-based pedagogy is used in various forms across various universities and institutes across the globe. For example, Department of Agronomy, University of Arkansas, US uses seminar-based pedagogy wherein students develop their literature review and hypotheses on a particular topic and discuss the same in their class in the presence of a supervisor and peer group (Davis & Wolf, 1988). Seminar-based pedagogy in most of the Indian Institutes of Management (IIMs) in India including

IIM Indore requires students to prepare a presentation of a published article from established journals. Though, these institutes use other forms of seminar-based pedagogical techniques on a case-to-case basis.

Schwartz and Tickamyer (1999) stated that seminar-based pedagogy could serve many functions. Seminar-based pedagogy had been widely suggested in doctoral programmes of sociology to train doctoral students in teaching (Krogh, 2006; Trautner, 2014), pharmacology (Palappallil et al., 2009; Murphy, Slack, Boesen, & Kirking, 2007) and agronomy (Davis & Wolf, 1988). It can also impart knowledge aboutthe area-specific course and can also serve critical roles in professionalisation (Trautner, 2014; p.62). For example, students socialise in these seminars with their peer groups (Gardner, 2005) and also learn to become independent learners while simultaneously enhancing their leadership, research, writing, and criticism skills (Eisenberg 1999; Maurer 1999; Schwartz and Tickamyer 1999). Given the wideness and variance in usage, it becomes pertinent to understand the relevance of seminar-based pedagogy at this stage.

There exist few fields were seminar-based pedagogy has been utilised and researched to a greater extent, for example, doctoral programmes in sociology (Trautner, 2014; Schwartz & Tickamayer, 1999; Maurer, 1999). However, there exist scant study which attempted to identify the relevance of seminar-based pedagogy in the coursework of doctoral programmes in management. Therefore, appropriate scrutiny of what kind of courses are well received using seminar-based pedagogy and which of this courses are 'strict no' with such pedagogies at this juncture will help in effective planning and implementation of coursework in doctoral programmes of management.

Pedagogical Relevance: To incorporate pedagogical relevance in the current study, initially the dictionary meaning of relevance were examined. In two of the most followed English dictionary – Oxford dictionary and Cambridge English dictionary, three significant characteristics of relevance can be factored out. The quality of being connected, appropriate, and useful.

"The quality or state of being closely connected or appropriate" (Oxford Dictionary)

"The degree to which something is related or useful to what is happening or being talked about" (Cambridge English Dictionary)

Later, the definition of *'relevance in education'* was also examined with the same purpose. Roberson (2013) gave two ways to provide relevance for students – utility value (use of the said pedagogy) and relatedness (connection with the instructor). The present study took cues from these different sources and only opted for two of the characteristics of relevance in education given the context of the study – appropriateness and usefulness. It further defined the relevance of pedagogy based on the appropriateness and usefulness of the concerned course's pedagogy as below;

- Appropriateness *defined as the quality of pedagogy that is suitable for a particular course*.
- Usefulness defined as the quality of pedagogy that helps assist in advancing knowledge and furthering research interest for a particular course

The third characteristics – connectedness or relatedness, prominently found in many kinds of literaturewas dropped. As the scope of the current study is only limited to coursework, the issue of connectedness does not cross among the doctoral students during this duration of their entire doctoral programme. More so in doctoral programmes offered in IIMs unless the coursework is cleared by the doctoral candidate, a research guide/s is/are not assigned. Therefore, the issue of connectedness seemed to be of little relevance for any doctoral candidate when she/he is not clear about their guide at this stage. Additionally, being connected to coursework instructor may explain about the relevance of the education overall but may not explain the relevance of pedagogy used in particular coursework.

Doctoral programmes at IIMs:IIMs are considered as premier B-Schools of India.The 20 IIMs constituted so far are majorly known to produce professional managers.They also offer doctoral programmes under the label 'Fellow Programme in Management (FPM)'. Of the total 20 IIMS, 13 IIMs so far offers this programme and 3 IIMs have initiated their selection for FPM programme for 2019-20 academic session. Unlike various other disciplines, FPM does not mandate post graduation in management in particular.Thus, the aspirants of FPM programme offered by IIMs come from diverse academic background.This uniqueness further builds a fertile ground to assess if seminar-based pedagogy is relevant for all such aspirants coming from all walks of life.

Similarly, the feedback of the participants who are at the receiving end of the pedagogy will further help practising academicians to accordingly structure their courses offered in the coursework based on seminar-based pedagogy (Drennan & Clark, 2009). As Rasmussen (2013) pointed out that seminar-based pedagogy is one of the complex forms of learning and complex learning demands suitable feedback. Therefore current study aims at understanding the relevance of the seminar-based pedagogy in the

coursework of doctoral programmes in management from students' perspectives in terms of its appropriateness and usefulness.

Methodology

Sample: Asthe study was confined toFPM (Doctoral) Programmes of IIMs, students from three IIMs were selected to be included in the study. One of the IIMs where the researcher belonged was selected automatically based on convenience, and the other two IIMs were selected randomly after categorising the IIMs by their existence. Among the older IIMs, IIM Ahmedabad and the newer IIMs, IIM Raipur was randomly selected. The entire list of FPM Scholars of these two IIMs and their email IDs were collected from the website of the respective IIMs (Please refer Appendix III), and the questionnaire built on 'Google Forms' (Please refer Appendix I) were sent to them. In all, a total of 211 (IIM Ahmedabad – 102, IIM Indore – 70, and IIM Raipur – 39) emails were sent across three IIMs. However of the total 211 respondents targeted only 21 respondents reverted, a poor response rate of only 10%. Of the 21 respondents, two of them uprightly stated that they have not been through any seminar-based courses and hence they were forced to discontinue. Thus, the current study is based on useful analysis of 19 responses. Age of the respondents ranged from 24 to 38 years. Please refer toGraph 1 for the area of specialisation and stage-wise description of the respondents.





Measure: The study is majorly based on an open-ended questionnaire,thoughthe questionnaire also included few objective-based questions. It was dividedinto four sections. First part introduced the participants with the objective of the study, a brief introduction of the various sections of the questionnaire, promises regarding the participants' confidentiality, and contact details of the researcher.
The second section labelled as 'Part A' seek demographic details. The third part labelled as 'Part B' of the questionnaire asked about participants' experiences with those seminar-based courses that they found most appropriate and useful. Finally, the fourth section labelled as 'Part C' asked about participants' experiences with those seminar-based courses that they found least appropriate and useful.

In order to understand the relevance of the seminar-based pedagogy through the students' lenses questionnaire included questions on appropriateness and usefulness of the seminar-based course. Thus, the present study defined the relevance of pedagogy based on the appropriateness and usefulness of the concerned course's pedagogy. The definition of appropriateness and usefulness were provided in the introduction section of the questionnaire. They were;

- *Appropriateness* was defined as the quality of pedagogy that is suitable for a particular course and
- 'Usefulness' was defined as the quality of pedagogy that helps assist you in advancing your knowledge and furthering your research interest for a particular course.

It was further assumed that once the respondents remember the exact seminar-based courses that they have experienced, it will make them provide inputs more specific to a particular course requirement. Hence, participants were first asked to name a maximum of five courses that were based on seminar-based courses. Later they were also primed to one such course that they found more or least appropriate or useful respectively. It was done by making them recall the names of the seminar-based courses they attended and then rating those courses on five-point scales ranging from '1' being 'least appropriate/useful' to '5' being 'more appropriate/useful.' Once they have rated a particular course on least to the more appropriate/useful continuum, they were asked to comment about the factors that as per their perception led them to rate these seminar-based courses atleast or more appropriate or useful. They were also asked to suggest measures to improve the appropriateness and usefulness of such courses further.

Procedure: The questionnaires were administered online.Questionnaires were generated on 'Google Forms,' and the link to the online questionnaires was sent to participants on email. Follow-upswere not made to participants who did not respond from IIM Ahmedabad and IIM Raipur. However few respondents from IIM Indore available in the campus were followed up personally by the researcher.

Observation: Few of the respondents from IIM Indore after filling the questionnaire complained about the length of the questionnaire and pain they felt while referring to the definition of appropriateness and

usefulness after every section. Similarly, after inquiring about feedback on questionnaire one respondent replied that she could not differentiate that there was the difference in terms of appropriateness and usefulness which was defined at the start of the introduction and hence she thought that those questions were repeat questions.

Results

The primary data collected through an online questionnaire was subjected to thematic analysis. Thematic analysis is the most widely used forms of analysis in qualitative research (Braun & Clark, 2006). Thematic analysis is a method for identifying, analysing, and reporting patterns (themes) within data (Braun & Clark, 2006; p.6). It also helps in interpreting the overall dimensions of the research topic (Boyatzis, 1998). Thematic coding involves recording or identifying passages of text or images that are linked by a common theme or idea allowing one to index the text into categories and therefore establish a "framework of thematic ideas about it" (Gibbs 2007).The top-down approach of thematic analysis was used to carry on the data analysis.Thus, the four themesof the analysis were identified earlier before the actual analysis at the formulation stage of the questionnaire for this purpose. These were;

- 1. 'courses using seminar-based pedagogy,'
- 2. 'courses perceived as most appropriate, most useful, least appropriate and least useful to use seminar-based pedagogy,'
- **3.** 'factors that make a course appropriate, useful, inappropriate and not useful to use seminarbased pedagogy,' and
- 4. 'suggestions to improve the pedagogy of a particular courseof the study.'

Courses using seminar-based pedagogy: While recapitulating maximum of five courses that are delivered through seminar-based pedagogy, a total of 46 different courses were identified by the 19 respondents, instead of expected 19 x 5 courses because respondents often repeated the same courses. Most of the respondents predominantly gave examples of their area-specific courses or general courses that are common to all irrespective of the field of pursuing doctoral programmes. Only three of the participants have named a few non-area specific courses.



Similarly, the majority of the participants (13 out of 19) found that seminar-based pedagogy is best suited to their respective area-specific courses. Only one participant chose to go with non-area specific course called 'Entrepreneurship'(participant was from OB and HRM), two participants chose general courses like 'History of Management Thought' and 'Academic Communication', and three participants found no course appropriate to be perceived as most appropriate course to be delivered through seminar-based pedagogy.Similarly, when inquired about the most useful course in terms of using the said pedagogy a total of 12 respondents found the right course from their respective area. A total of 5 respondents repeated the name of the same course as most useful that they found most appropriate as well. However, the majority of the respondents (8 respondents) did not consider that courses which could be appropriate in terms of seminar-based pedagogy should be necessarily considered as useful at the same time. As expected the ratings given to the courses identified as most appropriate and useful were rated on an average very highly at 3.94 and 3.89 respectively.

Only four respondents found their respective area-specific courses to be least appropriate in using seminar-based pedagogy. Of these fourrespondents, two of these respondents' were not from the area of management before enrolling themselves in the doctoralprogramme in management. Two of the other respondents found the non-area specific course as least appropriate in terms of using seminar-based pedagogy. Majority of the respondents (7) found general courses (courses common to each respondent irrespective of their areas) as least appropriate to be delivered through seminar-based pedagogy. Of these seven respondents, six of them identified research methodology subjects like 'Qualitative Research Methods,' Statistics in Management Research,' 'Action Research Methodology' and 'Quantitative Research Techniques' as least appropriate to be delivered using the said pedagogy. One respondent chose to claim none of the courses should be using this pedagogy, and 4 of the participants (3 from marketing) claimed that there is no course which is least appropriate to be delivered through this pedagogy.

Similarly, when inquired about the least useful course in terms of using the said pedagogy only a total of five respondents found the least useful course from general research methodology courses. A total of eight respondents repeated the name of the same course as least useful that they also found as least appropriate. Three respondents did not consider that courses which could be least appropriate in terms of seminar-based pedagogy to deliver should be necessarily considered as least useful at the same level. As expected the ratings given to the courses identified as both least appropriate and useful were rated on an average very low at 2.16.

*Factors to consider in using seminar-based pedagogy:*One of the factors that were highlighted in making seminar-based pedagogy as highly appropriate included the nature of course which essentially demanded participants' perception. Perception of the participants about seminar-based pedagogy wherein they are encouraged to participate and motivated for richer contribution in the overall discussion. Some of them also highlighted that this pedagogy also forces them to study the readings and make presentations on the topic beforehand because of the pressure from the instructor. Another factor that was emphasised included that courses massive on theory can be best understood through reading and presentations. Finally, it was also pointed by few respondents that it facilitates them in discussing literature on relevant topics, identifying the research gap and superimposing the literature on practice to find viable solutions.

Majority of the factors that were identified for courses appropriate in using seminar-based pedagogy were repeated in explaining the usefulness of the pedagogy as well. Though, one of the factors stressed was the experience of the instructors in using seminar-based pedagogy effectively. Insights from the instructors werealso considered a handful by the respondents in rendering seminar-based pedagogy useful. Lastly, flexibility in delivering courses was also identified as one factor that makes the said pedagogy useful.

Primary reasons used in claiming the use of seminar-based pedagogy as least appropriate in some of the courses offered in the coursework of the doctoral programme in management included 'strict no' to use of this pedagogy in method-oriented courses. Methodical courses which involve modelling (marketing models and econometrics), research methodologies, mathematics, and so forth were stressed to be not delivered through this pedagogy. Another factor was about the length of the reading materials to be presented in the class. It was suggested that the larger the length of the reading materials less appropriate it is to be delivered through the said pedagogy. It was also pointed out that the entire appropriateness of the pedagogy is lost if students are unable to prepare the readings thoroughly. Lastly, the passive role of

instructors and students not presenting the paper was cited as other essential factors that could render seminar-based pedagogy least appropriate.

Most Appropriate	Most Useful	Least Appropriate	Least Useful	
 Encourages participation and motivates for richer contribution Forces to study and make presentations Facilitates in discussing literature, identifying research gaps, and superimposing literature on practice to find viable solutions 	 Experience of the instructors to use seminar-based pedagogy effectively Insights from the instructors Flexibility in delivering courses 	 'Strict no' to use seminar-based courses in method-oriented courses Length of the reading material The inability of the students to prepare readings thoroughly Passive role of instructors and attending students 	 Active participation becomes difficult in a discussion initiated by the instructors in non-area specific courses. Other factors were similar to the least appropriate section. 	

Similar reasons were pointed to render seminar-based pedagogy as the least useful. Except that one of the respondents also highlighted that active participation becomes difficult in a discussion initiated by the presenter in certain non-area specific courses in which they are not much aware. Thus, there is no value addedfrom such courses, and it leads students nowhere.

Suggestions to improve seminar-based pedagogy: Suggestions were made in general for both types of courses, i.e., courses either identified as appropriate and useful or inappropriate and not useful. Five of the respondents chose not to suggest any idea to improve further the appropriateness of seminar-based pedagogy in such courses that were identified as most appropriate. However, the majority of them (13 respondents) provided further suggestions to improve the appropriateness of the pedagogy further. Majority of these suggestions included an increase in the duration of time and a reduction in some readings. Few of them also suggested increasing the number of lectures in a particular term but reducing the number of lectures per week.

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Most Appropriate	Most Useful	Least Appropriate	Least Useful
 Five respondents chose not to suggest Increase in duration of time and reduction in a few readings Increasing the number of lectures per course but reducing the number of lectures per week Choose articles shorter in length Assignments to be discussed in class and should involve empirical testing Alternative pedagogy – Socratic, class-discussion, and field study. 	 Four respondents chose not to suggest Seven gave the same suggestions as in most appropriate section Other suggestion – Providing students with course requirement a month before along with simple versions of supplementary readings 	 The instructor should encourage class participation by asking questions, taking small quizzes, and explaining concepts through real examples Alternative Pedagogy – traditional lecture method (methodological courses). 	 Six respondents chose not to suggest Eleven gave the same suggestions as in most appropriate section The inclusion of practitioner insight Alternative Pedagogy – Socratic method

Similarly, a request is made to choose articles which are shorter in length (number of pages). It was also suggested that assignments like term papers have to be based on the discussion in the class and should involve empirical testing for further understanding of the course. Similarly, instructors were expected to stress on concrete outcomes and summarisation in the initial and last lecture of the entire course. Lastly, some of the alternative pedagogy suggested for few courses included Socratic pedagogy, class discussion, and field study.

A total of four respondents chose not to provide any suggestions to improve the usefulness of seminarbased pedagogy in already cited useful courses, andseven respondents chose to offer some suggestions that they provided to improve the appropriateness of seminar-based pedagogy. However, few of them suggested increasing the number of students in the class, possibly to share the burden of making presentations. Other suggestions included providing the students with the course requirement almost a month before and also suggesting simple versions of the supplementary readings.

In the courses found least appropriate to be delivered through seminar-based pedagogy, students suggested to include a more traditional lecture method (3 respondents) alternatively, especially for the general methodological courses. Other alternatives suggested included discussion-based pedagogy (2 respondents) and field engagement (1 respondent). 6 respondents chose not to suggest anything. Rest of them suggested minor improvements before using seminar-based pedagogy in such courses. These included suggestions to instructors to encourage participants in class participation by asking questions and taking small quizzes and explaining concepts through real examples.

Again six respondents chose not to suggest any remedies for courses found to be least useful when delivered through seminar-based pedagogy and 11 respondents repeated the suggestions from the previous section. Two of the other respondents urged for the Socratic Method as alternative pedagogy and advocated for the inclusion of practitioner insight in each seminar-based pedagogy courses.

Discussion

Some of the significant findings from the results can be enlisted as follows:

- Seminar-based pedagogy is extensively used by major IIMs in the coursework offered to their doctoral programme students. A total of 46 names of different courses were listed by the students when asked to name only five such courses.
- Area-specific courses were identified as appropriate and useful in using seminar-based pedagogy. Some of the students who suggested that even seminar-based pedagogy is not relevant for areaspecific courses were not from the management discipline previously. This observation further suggest that though the students took admission in a particular area of FPM they do not had prior academic exposure to the same discipline. As such technically even the area-specific courses were treated as similar to non-area specific courses by these students.
- Non-area specific and general methodology courses were suggested to be used through other alternative pedagogies like lecture method but not using seminar technique.
- Factors such as facilitating discussions, the pressure to prepare readings beforehand, flexibility,better understanding and familiarity with the literature and research gap were identified as encouraging to perceive seminar-based pedagogy as appropriate and useful.

 Cautions were asked to take in terms of further improving the appropriateness and usefulness of seminar-based pedagogy. These included reducing the length and number of the readings, increase in the overall duration of the courses, instructor and practitioner insights, and encouraging classroom discussions as instructors' responsibility.

Theoretical Implications: The paper helps in establishing a typology for courses that could be deemed fit to be facilitated using seminar-based pedagogy. It helped in formulating following four typologies - general courses, methodological courses, area-specific courses, and non-area specific courses. It also provide initial support for relevance of seminar-based pedagogy only to one type of course identified – are-specific courses. Similarly, the extensive use of seminar-based pedagogy and its near acceptance by the students enrolled in doctoral programmes of management advocates for seminar-based pedagogy to be treated as signature pedagogy by the researchers in the area. An extensive observational or ethnographic study will further help in establishing the claim. Specifically studying the class habits of students developing out of seminar-based pedagogy and its further extension in professional life through a thorough longitudinal study has the potential to establish seminar-based pedagogy as a signature pedagogy for the academicians. Thus, this study helps in elaborating the scope of seminar-based pedagogy from being just one pedagogical tool to become signature pedagogy at least in management doctoral programmes.

Practical Implications: Few practitioner insights can be drawn by the academicians teaching coursework in management doctoral programmes from the study. Firstly, it discourages them to use seminar-based pedagogy for non-area specific and general methodology courses as these courses are not well received by the students in general through the said pedagogy. Secondly, it also suggests to carefully choosing the articles to be included in the readings in terms of number and size. Thirdly, seminar-based pedagogy is more welcome in large classes in comparison to classes with fewer students. Fourthly, instructors should be more active in terms of encouraging the class to participate. Lastly, instructors are also expected to provide details of the course around a month before the commencement of the course along with comprehensive supplementary readings.

Limitations: Some of the limitations that might havepotentially affected the overall findings of the results include:

• Sampling: Data were collected from three IIMs, and the representativeness from each of these IIMs was also not adequate. Other management institutes were also ignored. The study was also affected through a low response rate; for example, out of 102 students from IIM Ahmedabad,

only 1 participant responded. The follow up process from the researcher was also not diligently taken up by the researcher except in IIM Indore (base of the researcher). Overall the final sample size of 19 is not ample to generalise the findings.

Questionnaire: Questionnaire was established online, and therefore researchers did not get the chance to clarify issues that some of the respondents could not understand. Though these doubts were cleared when they approached the researcher, by that time they had already filled the form. Few complaints were also noted in terms of the length of the questionnaire. Though, complaints varied from participants to participants. Lastly, few participants also complained in terms of differentiating between the two dimensions of relevance used in the study, i.e., appropriateness and usefulness. However, a total of only five respondents name the same course in both appropriate and usefulness dimensions.

Future Research Directions: Apart from meeting the limitations of the study as cited above future research may also look to include other stakeholders of seminar-based pedagogy, for example, faculty members, and supervisors. Similarly, an ethnographic study can be conducted to verify if seminar-based pedagogy is taking the shape of signature pedagogy in the field of doctoral programmes in management. Finally, researchers in the area may also look to explore the feedback on seminar-based pedagogy using objective scales for broader reach.

Conclusion: Courseworkin doctoral programmesand itsrelatedpedagogy hadbeen largely ignored for its relevance in terms of appropriateness and usefulness. Seminar-based pedagogy as one of the widely accepted pedagogy in various doctoral programmes including management has also been not subjected to test for its relevance in past researches. Current study highlighted these issues and developed a case for the relevance of the said pedagogy in area-specific courses. Though, unintentionally it also advocated testing this pedagogy as one of the signature pedagogy in management doctoral programmes on account of it being used extensively by the instructors and general acceptance by the students at least in area-specific courses. The study also cautions on the use of seminar-based pedagogy for general methodology and non-area-specific courses.

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Appendix

Appendix I: QUESTIONNAIRE

SEMINAR-BASED TEACHING IN VARIOUS COURSESDURING COURSEWORK OF DOCTORALPROGRAMMES

Dear Participant,

This survey is with regards to understanding the appropriateness and usefulness of seminar-based teaching in various courses during the coursework of doctoral programmes. It will help us in understandingthe various aspects of determining the relevance and necessity of seminar-based teaching in doctoralprogrammes. This survey is divided into three parts. First part seeks some of your demographic details. The second part of the questionnaire asks you about your experiences with those seminar-based courses that you found most appropriate and useful. Finally, the third section seeks to understand yourperceptions with regards to those courses that you found least appropriate and useful. It should take 15-20 minutes of your time to complete.

For research purposes, 'Appropriateness' is defined as the quality of pedagogy that is suitable for aparticular course and 'Usefulness' is defined as the quality of pedagogy that helps assist you inadvancing your knowledge and furthering your research interest for a particular course.

It will be difficult for this research to reach its completion without your co-operation. Youare givencomplete assurance that your responses will be used only for research. The information that you will provide will be kept confidential. You can give your responses without any hesitation. If you have any questions or clarifications, you are always welcome to ask. You can use the contacts givenbelow.

Thank you very much for your participation and co-operation.

Thanks and Regards, Manoj Kumar Yadav, FPM Scholar (OB & HR), Indian Institute of Management, Indore Email: f17manojy@iimidr.ac.in Mobile: +91-8169215030/9820125167

PART A: Demographic Details

1) Email: _____

- 2) Name of the Institute in which you are/were enrolled for Doctoral Programme:
- 3) Age: _____
- 4) What is the current stage of your Doctoral Programme?
 - a. (Mark anyone oval)
 - b. Early Stage (0-1 Years) :
 - c. Middle Stage (1-3 Years)
 - d. Final Stage (3-5 Years) :
 - e. Completed
- 5) What is the area of your Doctoral Programme?:

6) Does your area of Doctoral Programme matches with your previous experience/education (forexample, Ph.D. in Management can match with previous managerial experiences or a degreein MBA/Other Equivalent degree)? *

(Mark only one oval)

- a. Yes 🔿
- b. No 🔿
- c. Mayb
- 7) Have you been through some courses during your coursework wherein the pedagogy wasseminarbased?

(Mark only one oval)

- a. Yes 🔘
- b. No 🔿
- c. After the last question in this section, stop filling out this form.
- 8) Name maximum of five courses that were delivered to you using seminar-based pedagogy *

PART B: Appropriateness and Usefulness of Seminar-based

Pedagogy based on Most Appropriate and Useful Course: Questions on appropriateness and usefulness are separate but has to be based on one such course thatyou found most appropriate and useful.

Name one such course that you found mostappropriate in terms of utilizing seminar-basedclass as pedagogy:

Based on your experiences from one such course which you find most appropriate of allcourses offered in coursework rate seminar-basedpedagogy on a five-point scale

(Mark only one oval)

T (A • /	
Least	Appropriate	
	FF F ····	

 $1 \bigcirc 2 \bigcirc 3 \bigcirc 4 \bigcirc 5 \bigcirc$ Most Appropriate

According to your perception what factors made you feel that seminar-based pedagogy in this particular course was appropriate.

Give your comments on making this course more appropriate (You can comment onincluding, excluding or modifying some of the factors to improve the existing pedagogy oreven use of alternative pedagogy to teach this course).

Name one such course that you found mostuseful in terms of utilizing seminar-based classas pedagogy:

Based on your experiences from one such course which youfind most useful of all courses offered in coursework rate seminar-basedpedagogy on a five-point scale

(Mark only one oval) Least Useful 1 2 3 4 5 Most Useful

According to your perception what factors made you feel thatseminar-based pedagogy in this particular course was useful.

Give your comments on making this course more useful (You can comment on including, excluding or modifying some of the factors to improve the existing pedagogy or even use of alternative pedagogy to teach this course).

PART C: Appropriateness and Usefulness of Seminar-based Pedagogy

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Pedagogy based on Least Appropriate and Useful Course: Questions on appropriateness and usefulness are separate but has to be based on one such course thatyou found least appropriate and useful

Name one such course that you found leastappropriate in terms of utilizing seminar-based class as pedagogy:

_____·

Based on your experiences from one such course which you find least appropriate of allcourses offered in coursework rate seminar-basedpedagogy on a five-point scale

(Mark only one oval)

Least Appropriate	$1 \bigcirc 2 \bigcirc 3 \bigcirc 4 \bigcirc 5 \bigcirc$ Most Appropriate
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According to your perception what factors made you feel thatseminar-based pedagogy in this particular course was not appropriate.

Give your comments on making this course more appropriate (You can comment onincluding, excluding or modifying some of the factors to improve the existing pedagogy oreven use of alternative pedagogy to teach this course).

Name one such course that you found leastuseful in terms of utilizing seminar-based classas pedagogy:

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Based on your experiences from one such course which you find least useful of all coursesoffered in coursework rate seminar-based pedagogy on a five-point scale.

(Mark only one	oval)
Least Useful	$1 \bigcirc 2 \bigcirc 3 \bigcirc 4 \bigcirc 5 \bigcirc$ Most Useful

According to your perception what factors made you feel thatseminar-based pedagogy in this particular course was not useful.

Give your comments on making this course more useful (You can comment on including, excluding or modifying some of the factors to improve the existing pedagogy or even use of alternative pedagogy to teach this course)

-----Thank you for your participation------

Applying Engagement and Application Based Learning and Education (ENABLE) – A Student Centric Learning Pedagogy for Effective Learning of Database Management System

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Abstract: Dealing with youth in higher education has always been a challenge. Specially, when they are equipped with electronic gizmos all the time. Even during the lectures! It is extremely difficult to engage them constructively in a lecture for an hour. To keep this new "Digital Generation" of students away from distractions and to make them learn concepts with excitement and enthusiasm, change in teaching pedagogy is essential. At Ahmedabad University, we believe imparting education is not merely about teaching and learning - but instead about providing students with an enabling environment where they can appreciate the context of what is being taught to them, learn the critical concepts of their respective disciplines, and develop the ability to apply them in real-life. The monotonous class-room teaching methodology which not only limits students' creativity and imagination; but more importantly fails to let them have a full context of concepts being taught to them. Ahmedabad University has therefore evolved a new framework to facilitate better learning, in terms of appreciation of context, understanding of concepts, and retention of ideas for the students. It believes "engagement" with the context and environment, and "application" of concepts are two most critical aspects of better learning. Hence, Ahmedabad University's pedagogy is named "Engagement and Application Based Learning and Education", in short "ENABLE". An ENABLE Course lays greater emphasis on "understanding the context" and "applying the concept" vs. merely learning the theoretical aspects of a concept. All major concepts during an ENABLE Course can be taught through key phases - (1) Engage, (2) Learn and (3) Apply with Plan, Analyze and Assess Phases being intermediary phases of engagement between the students and faculty. We adopted this pedagogy for "Database Management System" course which was opted by students of Integrated Masters of Computer Applications programme. The aim was to teach Database concepts from the context of real world scenario. Industry projects were assigned to small groups of students where they were engaged in real scenarios for which they had designed and developed logical and physical databases. Theoretical concepts required for database designing were introduced as and when needed during the project implementation. We served as facilitators rather than teachers, thereby transferring the control to students so that they can actively participate in the course and learn at their own pace. It was observed that grasping and understanding complex concepts was much easier through this pedagogy. Evaluation was done continuously in the form of quizzes, discussions, class

participation, presentations, peer and teachers' qualitative and quantitative feedback, etc. In this paper, the detailed implementation of this ENABLE pedagogy for the Database Management System course has been described.

Keywords: ENABLE, Teaching-Learning Pedagogy, Project based learning, Database Management System

Introduction

"The teaching must be modified according to the needs of the taught" – Swami Vivekananda. (*Wikisource, 2014*)

The education ecosystem is changing as there are new inventions introduced to its stakeholders. Several pedagogical changes can be observed as we have moved from traditional one way chalk and talk method to interactive classrooms. As there are advances in technologies, where audience can view the content on demand, at their own pace and according to their need, the education system also has to shift its focus from teacher-centered methods of teaching to student-centric learning environment. Such environment allows the students to control the learning process as per their own pace and need. To develop the student-centric learning environment, many educational institutes are experimenting with new pedagogies such as Active learning, Interactive learning, inquiry based learning, etc.; all of which encourage students for active participation and develop their skill of asking questions.

Considering current education scenario where each individual is surrounded by distractions, it is important to involve students in the learning process; else they can easily drift away from learning and get lost in the world of gizmos and gadgets. Also, with the easy accessibility of tremendous information on internet (where not every bit of information is correct or relevant), the young minds may tend to lose the contact from the learning environment and slide into the shell. This, sometimes leads to a situation where student has the self-learning capability and good academic performance but is not capable of working in the team. It is not easy for him/her to listen to ideas of peer and adapt it. However, the real world scenario is different where most of the projects target the societal problems and are implemented as a team. Hence, it is the need of time that today's education focuses on the real world problems and help students in developing their team work skills.

In the traditional learning method, student learns the theoretical concepts without knowing its context in the real world scenario. Project based learning unlike traditional method makes student work for solving the real world problem using the theoretical concepts. This not only helps them to map the concepts with context but also develops the skills like analytical thinking, team collaboration, communication, decision making, etc.

In next section, we explain different student centric pedagogies practiced in the current education system followed by section that explains the ENABLE framework.

Student Centric Learning Pedagogies

The student centric learning keeps students in the center of the learning process. It is designed to allow students to take hold of the learning process and learn at their own pace. Unlike traditional teaching methods where faculty plays the role of instructor and decides the content to be delivered in

the limited time, in student centric approaches faculty plays a role of facilitator who is responsible for providing guidance to the students during their individual learning process. The techniques such as class discussions, simulations, role plays, collaborative tasks, group projects, etc. can be used for successful implementation of student centric approaches.

Different Student Centered Learning Approaches (Froyd and Nancy, 2008) :

Inquiry based learning – This technique encourages students to ask questions unlike traditional method where usually there is one way communication from teacher to students (Edelson, Gordin and Pea, 1999).

- Collaborative learning It is an approach where students are made to work and learn in groups thereby developing their skill of team collaborations (Dillenbourg, 1999).
- Cooperative learning This technique focuses on how students interact with each other rather than individual student or interaction of faculty and student. Students are encouraged to work together and solve a problem (Slavin, 1980).
- Problem based learning This approach helps in developing the skill of critical thinking and problem solving. Group of students are engaged in complex problems which can come from cross disciplinary platforms (Awang and Ramly, 2008, Steinemann, 2003).
- Active Learning Students are actively involved in the learning process through continuous interaction, role plays and simulations rather than passive listening (Johnson, Johnson and Smith, 1998)
- Project based learning An approach in which students explore real world complex problems and gain knowledge while trying to solve them (Blumenfeld, et al, 1991, Doppelt,2003, Thomas, 2000).
- Just in time learning Learning is available on demand and student can use it as and when required (Growthengineering, 2019).

ENgagement and Application Based Learning and Education (ENABLE) Framework @ Ahmedabad University

"A Pedagogical style that is both engaging and displays freedom and tolerance is the essence of academic freedom" – Pankaj Chandra (Chandra, 2017)

ENABLE is the Ahmedabad University's framework adopted from Project Based Learning methodology. It is a proprietary methodology developed to enable students to engage better with and appreciate the context of what they learn, and apply their learning more effectively. This framework makes learning engaging and practical rather than being theoretical monologue. Figure 1 shows 5 phases of ENABLE as explained below. However, there is no fixed sequence in which the phases are

executed. They can vary as per the requirement of the course and most of the times they are iteratively executed.



Figure 1 Phases of ENABLE

- 1. Plan In this phase students try to understand the objective of course and list the learning outcomes (more specifically practical knowledge) that they aim to achieve by learning the course. At this very stage, students also brainstorm about the real world context where the concepts learnt through the course are applicable.
- 2. Engage This is the phase of ENABLE where students undertake any project or complex problem on which they work throughout the course tenure. This phase is aimed at helping students to better understand the context of the course and realize the need to theoretical concept to solve the problem.
- 3. Analyze In this phase, students are expected to Analyze and reflect on the learnings of Engagement phase. During this phase, students can introspect about their contribution to the project, know the views of peers and discuss how they can improve as a team.
- 4. Learn This is a phase where students can map theoretical concepts of the course with the practical observations.
- 5. Apply As by now students have already mapped the theoretical concepts with the practical observations, they can apply the concepts on the real world projects/situation/problems for solving them.

Implementation of ENABLE in the Course "Database Management System"

In this section, we explain the implementation of ENABLE framework in "Database Management System" course.

Course Description

This is a foundation course which covers basic and advanced concepts of database management such as database designing, transaction management and database side programming in Oracle RDBMS.

Course objective

The course is aimed to make students realize the importance of structured database design thereby developing their skill of database designing and management which can be applied in real time software development. The goal is to acquaint students with concepts of relational database, Structured Query Language (SQL), transaction processing, database recovery and security.

Outcomes

As outcome of the course, students are expected to use the knowledge of basic and advanced concepts of database management and design well-structured database for the real world project. In addition the data stored can be retrieved and manipulated using fourth generation language SQL and scripts with procedural language PL/SQL. During all the data retrieval and manipulation, transaction management and concurrency control is done for simultaneous transactions.

Expectations from students

As the pedagogy is student centric, it is expected that students take the lead and decide their pace for learning. It is very crucial for students to understand the project from the real world scenario and visualize the data being used in the proposed system. This information which is generated after analyzing the requirements can be further used to integrate relational database management system concepts and design a data model for the project.

Types of Project

To bring out the essence of ENABLE pedagogy and map the context of theoretical concepts with the real world scenario, students are made to work on the complex projects which are obtained from Companies from various domains. Below are some of the projects on which students have worked:

General Development Control Regulations (GDCR) Guide – The aim of the project
was to provide in-depth analysis of general development control regulations of real
estate under Municipal Corporation or Ahmedabad Urban Development Authority
limit. It was designed as ultimate mobile guide for builders, architects, surveyors,
property estimators, banks, prospective property buyers and construction industry
students. This application was developed to help user to get instant information of

very important regulations like FSI, Built up area, building height, building use, margins, common plot, parking etc.

• Maa Store - The online store of local Kirana shops and Street vendors. This system was designed for general public (more specifically working people) who purchase their daily essentials using smartphone. The idea behind the project was to employ house wives as the manager of the group of Kirana stores in their area and make the purchase on behalf of customers such that the best quality goods are made available to the customers in reasonable price. Hence, customers do not have to take the trouble of visiting multiple stores and placing the orders.

Course Outline

The complete course was project driven and delivered in 40 sessions of 1.5 hours each. The detailed plan of course is as follows:

Project Activities	No. of sessions allocated for activity	Theory concepts explored
Overview of ENABLE, Discussion of data, information and databases, Models used to represent data	2	Discussions about real-time systems, formats used to store data, processing methods used to get meaningful information
Team Formation with project assignment	2	Group discussion, Understanding the project
System Requirement Identification and Analysis	2	Detailed analysis of project requirements, prepare SRS document
Project Analysis and Conceptual Model Designing	3	Building Entity Relationship Model, learning the concepts of Key attributes, constraints, cardinality
Project Analysis and Logical Database Designing	1	Need for table normalization
Project Analysis and Physical Database Designing (Improving the database structure)	3	Normalization process-1NF, 2NF and 3NF
Research Paper Reading and Discussion, Project Engagement	3	Different types of keys, architecture of DBMS, Study of large database design

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Project Analysis and Physical Database Designing (Reducing data redundancy, using composite key, maintain consistency of data)	2	Surrogate key considerations, De- normalization
Project Presentations and Review, Peer Feedback	2	
Implement Physical Database design using RDBMS	2	Create Tables, set relationships
Project Implementation, Database Refinement, transaction control	2	Advanced Database Concepts- Transactions and Concurrency
Project Implementation, Data management	2	Storing, retrieving and updating data using SQL
Achieving complex data retrieval and manipulation in Project	2	Use of joins and sub queries
Generate reports as per the clients need	2	Use of various SQL concepts
Project Implementation, Discussion of methods of data retrieval from the database	3	Writing procedures and functions using PL/SQL, built-in functions, views
Discussion and implementation of stored procedures required to process data of the project, Problem Solving	3	Locking methods to ensure data integration and consistency, Distributed Database Systems
Discussion and implementation of validating data using triggers, Problem solving	3	
Final Project Presentations and Evaluation	1	

The flow chart of project activities throughout the course is shown in Figure 2 and describe below.

- 1. Introduction about projects Faculty explained objective of the course and expected outcomes from the project implementation
- 2. Group Formation The students had to work in team for project. The team size was of 3-5 students. The groups were formed by keeping in mind the student's academic background and interest, gender, skills and pace of learning.
- Assign projects to groups The projects were assigned according to the group size i.e. smaller group was assigned relatively small project. Students worked on real time projects which were assigned by the software company - Indylogix Solutions, Earthern Orbit – An Architectural Firm and the Startup by Mr. Ram Motwani who

was a student of IIM-Bangalore. The well-defined problem definitions were provided by the companies.

- 4. Students start working (Engage) on project
 - Understand the problem definition Students were allocated 2 sessions for understanding the project definition provided by the company. During this phase they met the company representative and collected requirements by using means like interviews, questionnaires, company manuals, project documents etc. These requirements were discussed with the faculty to get required inputs.
 - Prepare draft of User Requirement Document The System Requirement Specification (SRS) Document was prepared by the team as initial draft.
 - Finalize the project requirements Here the teams refine the requirements as per the discussion done with faculty, with their peers and company. After consensus they finalized the SRS document.



Figure 2 Flow chart of activities in Project

- Build process flow model To understand the project functionalities and flow of the system, teams were asked to build the Data flow diagrams.
- Conceptual/Semantic Model In order to implement the functionalities identified through process flow model, structured data storage and retrieval is required. For this purpose, abstract or visual presentation of system's data need to be designed. Teams have generated Entity Relationship diagram which depicts association among entities, constraints and attributes which can be further converted into relational database design.
- Logical and Physical Database Design The above designed conceptual model is further converted into database design (Tables). The tables are documented as Data Dictionary which contains table description, attributes and their description, entity and referential integrity constraints, other constraints and format.
- Data Manipulation using Structured Query Language After tables are created, data is stored and manipulated using fourth generation database query language SQL. Besides this, students learnt database programming to develop stored procedures, functions and triggers.
- Connect Database with User Interface Here teams learned procedure to connect database with User Interface using ODBC/JDBC (Open Database Connectivity/Java Database Connectivity).
- 5. During project implementation, teams were asked to refer the provided reading/reference material and relate the theoretical concepts with its real world context. Though major role of faculty was of facilitator, as and when required the theory sessions were conducted in addition to class discussions.
- 6. Project Presentations -Regular presentations were done by teams to demonstrate their progress and to showcase tangible outcomes of project.

Tangible Outcomes of Project

The tangible outcome of the implemented project were – SRS, ER Diagram and the Database created using a Relational Database Management system. The project report prepared by teams include following details:

- Project Definition
- Identified stakeholders and their role in the system
 - System Requirement Specification
 - Describe scope of system
 - Problems in existing system
 - Functional requirements of the system
 - Non-functional requirement of the system
- Study of competitive existing systems
 - Project Implementation
 - Identified Entities

- Entity- Relationship Diagram
- Data dictionary with constraints and data types of attributes
- Report generation through queries written using Structured Query Language
- Stored procedures for project functionalities
- Triggers applied on the tables for validations
- Transaction management and concurrency control mechanism applied for project

Assessment and Evaluation

The assessment and evaluation of students was based on following criteria. Faculty gave final grades by combining all the following criteria. Each criteria had due weightage which contributed in student's final grades. Maximum weightage was given to "Project" as it is the essence of this pedagogy.

- 1. Class Participation: Faculty had monitored each student during sessions and noted down the points such as how much they were contributing in the team, their behavior with other team members, involvement in the project, activities done inside the class, how much time they had spent on project besides regular sessions, etc. To know about this, faculty regularly interacted with whole team and team members.
- 2. Continuous Evaluation through Quizzes and Presentations: During the semester, four surprise quizzes were conducted to assess students' understanding of project and concepts. i.e., whether students were able to relate real time context with the theory concepts or not. Faculty gave inputs and guided them if they were deviated from the actual learning. Besides this, four intermediate quick presentations were given by teams about their project. They were assessed on the basis of their project progress.
- 3. Mid Semester Project Review: Each group was given time of 30 minutes to present the project to showcase and to explain project outcomes SRS document and ER diagram. Teams were evaluated on the basis of correctness of the documents and understanding of the concepts related to these documents.
- 4. Peer Feedback Qualitative and Quantitative (Anonymous), Face to Face (not considered for evaluation): Peer feedback was one of the important component of assessment. During mid-semester, each team member shared their views about their peer team members on face. The purpose of this feedback was to let each student know what his/her peers' opinion about him/her. This feedback was not counted in the final grade of the student, but its purpose was to help student improve as an individual and as a team member. The anonymous qualitative and quantitative feedback was taken at the end of the semester. The tool "Teammate" was used for this. In qualitative feedback, students were asked to submit half page description about each of their team members. The qualitative (descriptive) feedback given by "Mansi Modi" for "Riya Choksi" is as follows :

"She was a silent group member of our group in starting. She was not giving ideas for the project but slowly she started giving ideas and also used to submit the work that was given to her. But sometimes she used to delay the work in starting. In the last phase of our project the group leader assigned us to make forms. So the work given to her was completely done on time by her. So as a good partnership with her in making forms I was never disappointed. She is a cooperative member in the group. She helped in preparing data dictionary and rough idea about requirements. She has a good knowledge in database so helps a lot in setting relationships. With the help of her normalization of the tables was done perfectly. Overall it was nice to work with her."

Each student had also given quantitative feedback for their peer team members including himself/herself on the scale of 100. In this method, student can give marks out of 100 to each team member, but the overall total must be 100. On the basis of standard deviation in marks, the final grade of an individual may be upgraded or downgraded. The final decision was taken by faculty after checking the genuineness of the feedback. The sample matrix of quantitative feedback is given in Table 2.

From the Table 2 it is clear that, "Dev Desai" is not honest in giving feedback because he has given highest feedback to himself which deviates a lot from the feedback given to him by other team members. But "Ayush Shah" has given honest feedback. Even he has given the lowest marks to himself! Also, the deviation of the marks in the case of "Mansi Modi" is the lowest, which shows that she got the most genuine feedback by others. Ultimately, faculty analyses all these things to upgrade or downgrade the final grades.

- 5. End Semester Project Review: At the end of the semester, the final project review for each team was conducted. Students had showcased and explained database prepared by them in detail with its relevance to theory concepts. They had also submitted project report in word document for which marks were given to team.
- 6. Theory and Practical Examination: Theory examination was held to evaluate whether students were able to apply concepts learnt on other applications (projects). They were given small problem definition and asked to prepare SRS, ER diagram, Database design and execute queries on the database. The problem was given by keeping in mind the exam time duration. They were allowed to bring their Course Workbook¹ during the examination in which they had maintained details of project, session wise work done, concepts learnt from the project, etc. throughout the semester.

			Feedback Given By					
		Jainy Mehta	Mansi Modi	Riya Choksi	Ayush Shah	Dev Desai	Standard Deviation	
	Jainy Mehta	23	22	21	23	12	4.66	
	Mansi Modi	20	20	20	21	17	<u>1.52</u>	
Feedback given to	Riya Choksi	20	21	21	21	14	3.05	
	Ayush Shah	18	17	18	16	13	2.07	
	Dev Desai	19	20	20	19	44	10.97	
Total		100	100	100	100	100		

Table 2 Quantitative Feedback Matrix

Digital and other tools used throughout the course

Various software tools were used by students and faculty during the course for different purposes. The brief details of these tools are given below.

- Teammate: This is an open access tool which was used to keep details of teams, to conduct surveys and to take quantitative feedback.
- Piazza: It was used for online and offline discussion outside the class. Students and faculty can post questions and answers on this platform which registered users can view.
- Moodle: The learning management system "Moodle" was used to share documents, assignments and to conduct online quizzes.
- Google Drive: It was used to share documents which require to be edited by many users in parallel.
- Google Form: It was used to record qualitative feedback.
- ENABLE Workbook of Ahmedabad University: This workbook which is copyrighted document of Ahmedabad University was given to each student at the beginning of the course. It has predefined templates and forms which students may fill up and refer as per their requirement. Theworkbook was not checked by faculty as purpose of creation of this book was to provide students freedom of expression. The screenshot of page filled up by one of the student is given in Figure 3.

Benefits of ENABLE over Traditional approach

- In traditional approach, students attend lectures during which sometimes they lose concentration. This result into rot learning without understanding and applicability of the concept in real life. There is no freedom of expression in this method. In contradiction, ENABLE is a student-centric approach which allows them to express, self-learn, work on real time projects with their peers and learn to solve actual problem. They can come with multiple solutions for the same problem as different persons in a group have different perspective to see and analyze the problem. Students become fearless in expressing their ideas because of frequent presentations and discussions. Because of this their confidence increase.
- Learning through ENABLE is very rigorous as students are learning the concepts by doing it. Theory is not taught directly. To understand the project and theory behind the implementation, they have to refer lots of reading material which cultivate reading habits. As they read a lot, they learn more concepts than what is actually prescribed in the syllabus. The whole process demands more time than traditional approach.
- Students devote more time in discussions, reading, learning and problem solving rather than sitting idle during sessions.
- Learning by doing make them learn the concepts forever because they have applied the concepts in real time (Felder and Brent, 2003).
- Students become more adaptive towards any problem and ready to face the problem with confidence. They develop habit to understand the problem first, rather than start doing it blindly.
- The projects assigned are always novel and unique, so there is no scope of copying.
- Apart from learning the core concepts, other skills which are required to work upon real life problems are also developed such as Communication, Good level of confidence, Analytical and logical ability, Personal growth, and Appreciation and respect for peers. Their horizon widens as they work with different people as a team.

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Figure 3 Screen Shot of ENABLE Workbook

ENABLE - Challenges and their Solutions

Challenges

- Project Selection and Assignment : Because every course has time bound, it is challenging for faculty members to select the proper project. Before assigning project to the students, the sessions should be planned meticulously, else it creates chaos in the class.
- Long contact hours : Students and Faculty both have to devote more time to do the project and to solve queries respectively. This result into long contact hours.
- Difficult to handle big class : It is difficult to handle the class and to guide the students if the class size is big.
- Syllabus is compromised : Sometimes it may happen that more concentration is given to project which may result into skipping theory concepts that are totally descriptive and that do not have direct application related to the assigned project.
- Difficult to keep students motivated : If the given project is very complex and students are not able to find solution for any intermediate problem, motivation level of few group members will go down.
- Conflict in group members : Because of different point of views, ego and same level of intelligence; conflict may occur among group members, which divide a group into small groups. These kind of situations delay the actual project.
- Lack of activity : The group members who are not motivated enough sit idle. They do not get involved in the project activities, which other members do not accept.
- Isolation of a group member : Because of nature of a team member or less involvement in the project or slow pace of learning, other team members do not care for that member. In a way, they isolate the person.

• Weak communication : The students who are very good in problem solving and applying the knowledge on real time projects may not be able to explain the work done by them or communicate effectively during presentation which mislead faculty during assessment.

Strategies adopted to overcome challenges

To overcome challenges of teaching through ENABLE are given in Table 3.

Challenge	Strategy Adopted
Project Selection	Before selecting the project, faculty have to check that it should not be very big and complex to be solved by students as well as not too small which they could complete very fast. Project should be selected in a way that after working on the project, student must learn the theory concepts of the course. Therefore, faculty have to work upon project before it is assigned to the team. They need to plan each session with predefined activities and time required to complete the activity by keeping in mind the context. Meticulously planned sessions give best result in terms of less chaos during the class and student engagement.
Long Contact Hours	Faculty have to provide enough reading material to resolve the queries. Also, digital tools like Piazza, Moodle, etc. could be used on which teams can post their queries 24×7 which could be answered by faculty or students of that course. In the beginning of each session, 10 minutes could be spent to discuss problems. In this way, long contact hours could be reduced.
Difficult to handle big class	If the class size is big, more no. of faculty may co-teach the course or teaching assistants may be assigned to faculty to balance the workload.
Syllabus is Compromised	Faculty can quickly discuss these topics in class, or ask students to read them before they attend the class and discuss with their peers. Theory assignment may also be given.
Difficult to keep students motivated	In this situation, faculty may provide some hints to solve the problem or advise them to go through similar type of case which happened in yesteryears. Faculty can conduct theory sessions in between to bring change or excitement in routine work. Faculty can appreciate their work and ask them to do documentation. This will make them understand that they have really done pretty good work till date. To break the routine, faculty may assign the activity which is not related to the project.
Conflict in group members, Isolation of a group member, Lack of activity	Faculty need to monitor teams continuously to find such situations. They can interrupt, overrule or get involved in the problem to resolve it and make them work as a whole team. The members who are spoil spots in the group may be assigned more challenging task and appreciate the work

Table 3 Strategies adopted to overcome challenges of teaching through ENABLE

done	by	them.
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Weak communication	When faculty realize that the students are not able to explain their work effectively, after presentation gets over faculty can ask questions which these students can answer effectively.
	these students can answer effectively.

Faculty and Student Experiences

The following experiences shared by the faculty members who had taught courses through ENABLE pedagogy.

"After teaching the course Database Management System through ENABLE for last two years, I experienced improvement in students' problem solving skills; boosted self-confidence, betterment in presentation and written skills, Respect towards peers and their opinions, Team management, etc. apart from learning core concepts. Learning by doing made them learn the concepts forever with development of self-learning capacity".–Shefali Naik, Faculty

"ENABLE is a major shift for faculty and students as the pedagogy has to be transformed in such a way that it is student centric rather than teacher centric. Assigning a project for the course was not a new thing to me, as I had been doing it for my courses earlier. However the concept of allowing the students to work on the project and introduce them to the required concepts while implementing the project was very interesting. ENABLE framework gave each individual in the class flexibility to learn in their own way. As a facilitator, I witnessed improved team collaboration, analysis, decision making and communication skills. Also, this methodology kept hold of student's attention and they were less distracted compared to traditional lecture sessions."– Kunjal Gajjar, Faculty

"The power of human cognitive mind pursues wide spectrum of knowledge and thinking abilities if one is exposed to learning by doing, which I observed and accomplished when I experimented through ENABLE pedagogy for one of my subject - "System Design for Societal Problems" at Ahmedabad University. The ENABLE pedagogy at Ahmedabad University is experiential learning framework developed to enhance students learning and engagement. To name a few, traits such as team-dynamics, time management, sense of inquiry and responsibility were observed during the course." –Jaydeep Raulji, Faculty

The following experiences shared by the students who had enrolled for the course Database Management System.

"Learning Database Management System through ENABLE did not only help me to understand the concept of the subject but it also allowed me to understand its importance. I realized its actual need in the outer world. I find myself to be lucky that I got an opportunity to learn this subject as an ENABLE course." –Jay Joshi, Student, Winter Semester 2017 "It was smart thing to provide us with some real work like project in the very second year. It gave me a very nice idea of how I need to work when actually in the industry. The steps we were told to follow were very well planned as I am still able to use those for my project work". The following experiences shared by the students who had enrolled for the course Database Management System. "–Poras Vyas, Student, Winter Semester 2017

"It gave me an experience of working in groups where each member have their own perspective regarding a problem and to come to a solution which everyone can agree. This course gave me a unique experience and I enjoyed this 'Learning while Doing' way of teaching." –Jainy Mehta, Student, Winter Semester 2018

"ENABLE – where we can learn things by experimenting the concepts which is quite different from the regular classroom classes while here we can engage with our teams, experiment and analyze the project given. The ENABLE course "Database Management System" is aimed to develop the techniques and skills of database designing which can be applied in real time software development. It was a classroom led by students and guided by Shefali Naik and Kunjal Gajjar. They both were engaging the students very well and were willingly to solve the problems every time." –Mansi Modi, Student, Winter Semester 2018

Conclusion

The aim of this paper was to present the ENABLE framework adopted by Ahmedabad University. This framework enables the students to map the theoretical concepts with the real world context. However, in certain scenario, the traditional lecture session could be the need of time. Hence, this framework even though being a student centric approach provides flexibility to facilitator where they can interrupt in the project implementation and introduce some critical concepts to the students. In this way, ENABLE is not the replacement of good old classroom teaching and does not compromise on the rigor of the course (Bansal, 2016).

The implementation of Student-Centric pedagogies is not an easy task as major shift is required from Faculty as well as Student perspective. This approach forces the students to step out of their comfort zone and think about critical problems thereby applying their knowledge to solve them. On the other hand faculty also faces challenges like maintaining the rigor of course, motivating students and preparing them for the shift etc.

Given the challenges faced due to shift in pedagogy, it is still the recommended learning method for students as it not only helps in learning concepts and professional skill development but also encourages them to think about the societal problems at the young age and find ways to solve them.

Acknowledgement

The authors acknowledge Management of Ahmedabad University for introducing student-centric learning pedagogy and motivate faculty and students to adapt it. We also acknowledge the efforts put in by Professor Pankaj Chandra, Vice Chancellor, Ahmedabad University and Ms. Juhi Bansal, Associate Director, Learning Initiatives, Ahmeddabad University for initiating idea of ENABLE framework which is adapted from Project Based Learning pedagogy.

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Visible Gap Identification in Vocationalisation of Higher Education

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Abstract: Identification of vocation specific gap in teaching-learning involves various steps to determine visible gaps in available study materials of technical education. The purpose is catered by the development of need analysis tool that will indeed address the identified problems in specialized content delivery in technical education of respective fields. Needs analysis tool looks at each aspect of current teaching-learning as well as make a reach to domain elements through appropriate learning resources. Based on identified gaps new learning resources can be carved to pursue long term goal of building a strong professional cadre of teachers and innovative teaching methodology. Working towards Identified gaps help learners to improve performance within the job environment by setting performance standards for skill acquisition, concept building and attitude towards industry. This paper will focus on methodologies and outcomes of Need analysis tool in higher education.

Keywords: Need Analysis Tool, Teaching learning centre, Learning Resources, Visible Gap

Introduction: Development of effective learning resource (LR) in teaching learning is analyzed as a huge requirement of running technical courses to fill vocation specific gap in higher education. The development of LRs in teaching learning center (TLC) should be synchronized with the present industry orientation and demand of technical expertise. It is must those newly developed modules should be capable enough to lay a foundation of the Skill based workforce generation. Identification of vocation specific gap in technical content delivery plays a vital role in today's rapidly growing technology. Working practices are becoming flexible these days and require immediate changes with the adoption of concurrent technological tactics in the respective field. At present content available in learning material for technical courses may not have prioritized or adopted the upcoming technologies. Similarly, the technical delivery content that is sustaining from a long time may not be applicable in the upcoming Industrial Scenario. There could be several other such issues that create the vocational gap and become responsible for emerging unskilled pool of graduates.

Need analysis tool is designed to identify visible gaps and utilize it while evolving new deliverable teaching content. Several sequential procedures had been followed to bring out authentic data of visible gap and maintain the effectiveness of need analysis. The project includes the participation of faculties from various states. The diversity bounded to design a typical Need analysis tool that should be applicable to all courses simultaneously regardless of curriculum, university or the region participants belong. In this tool, efforts have already been made for sorting and classification of possible visible gaps that are listed after multiple rounds of discussion with the field experts. Users can select their choice among the listed visible gaps for their respective field of expertise.
The tool also provides an option for entry of unlisted vocational gaps other than mentioned that may occur while technical content delivery. Also, emphasis on possible resolutions of identified gap has been provided in the tool and participants can respond immediately to achieve the best outcome envisioned in the project. Eventually, the tool covers contact & experience details of the interested participants who are willing to work on the development of new learning resources in their area of specialization. The paper has described a detailed aspect of Need Analysis Tool.

Literature Review

- 1. Technical and vocational and training is playing a vital role in expanding job opportunity, support economic development, enhance the quality of employment. This paper aims to present a perspective on the TVET development. To support present economic and social developments, vocational industry and school enterprises interaction are one of the most efficient methods for vocational education. Required skills-based training to the teachers is the guarantee for the development of vocational education. A wide variety of activities and experiences that support vocational education has provided by the information and communication technology The improve will make the TVET more sensitive to economic and social changes and current demands.
- 2. The main purpose of this paper is to identify teachers who support learning which is based on current technology requirement in industries. Results of this paper reveal that teachers' support on various learning channel, learning based on enhanced and current technology, teaching resources which can support and facilitate self-monitoring teaching and learning. It is considered that online platform also suggested for sharing experience of teaching and learning, learning resources between different institutions to support current requirement based learning practice. The main purpose of sharing to address t critical issues.
- 3. In the context of professional education and higher education, employability plays a vital role. This paper address to express researchers views on job skill gap, employers view on lack of employability and employability skills. Besides addressing on employability, this paper included bridging the gap between industry and academia or in other words bridging the skill gap. The paper reveal hypothesis's to researchers to work and focus in this area i.e. skill gap.
- 4. This paper focuses on the outcome of training need analysis. Data of 123 participants is taken here those are working in particulars organization of Dehradun location. Some important way like the skill and knowledge required by the client, team, appraisal, direct observation made to identify the training needs and Customer Satisfaction Index. In this paper, it is found that proper training process for need identification passage through with smooth flow information and help organization/industry to enhance productivity by enhancing employee productivity. In this paper, many suggestions and presented for increase competitiveness among employee on basis of enhancing skill.
- 5. This paper address the empirical studies, survey of various organization, report of many committee and commissions which clearly highlight that there is not proper structure and sudden vocational courses introduction at first-degree stage. The main problem derives is protecting technology and effect of globalization cannot alone restructuring vocationalisation of higher education. This paper gives information about equipped with every individual potentiality must be exposed and refined to make enable him or her potential worker and a devote to the progress of the society of which they are a member. Any country can achieve complete economic growth if it gets through to make the most of all the talent and country progress mostly depends on the manpower utilization efficiently. The conclusion of this paper is restructuring whole higher education system along with proper planning and vision. Our country identifies the need for fundamental reform in education and restructuring various courses.

- 6. TVET bring about learning which makes people more productive and relevant in a particular area of economic and technological activities. To meet the demand of workplace for skilled manpower and also produce manpower who will be equipped with saleable skills for employability. To achieve this, educational institutions must collaborate with industry in order to bridge the gap between industry and educational institutions. Through this paper, examine excellent techniques which help in practicing in TVET workplace collaboration, bridging the gap between skill and industry to meet the need of manpower of current requirement.
- 7. This paper aims to find various researches which is conducted to specify the requirement that will have to satisfied by implementation of training in vocational higher education programme which is considered as one of the most effective tool of meeting demand. In this paper, three categories of major questions is considered, first one is school able to achieve aim of competencies-based education, second is up to what extent formal education furnishes people to work and the last one is to what extent should vocational education and training impact to work. The main aim of this research is to analyze the finding of market research and move to the proceed to the guidance of a particular design of curricula to maximize the effectiveness of TVET. More than 1000 sample of clerical staff and senior administrative officer is surveyed. After distributing a questionnaire to all employees, an interview was conducted. On the basis of such methods, it is possible to collect and combine professional based knowledge with experimental data in order to make instructional decisions. Eventually, as a conclusion, data identifies by the researchers are elaborate in detail and analyzed to confirm that relationship of market research, curriculum design, vocational education, and training will be successful and effective.
- 8. In this paper, gap focused on theory practice in technical vocational education. In order to technology learning, theory concept and considered practice and how to manage in education is considered and discussed. This paper emphasis on practice and theory in technical education. In this paper research questions related to the experience of theory of pupils, teachers, supervisors and relation between teaching and learning in technical education. Interview of pupil, teachers and supervisors are analyzed and focusing on the practical learning and practicing. Result concludes that theory experience and practical practice concerning a dualistic view along with interwoven way.

Problem Statement: Various opinions are there from experts on the development of the proactive courses. The way to deal with the issue of course development is still not concluded. The diversification was also a major factor, therefore the need of cross impact analysis techniques is analyzed. Problem and cause analysis can be done through certain procedures. It is more essential to bridge the gap of teaching learning with concurrent leading technologies. The expected response is also in benefit of teachers as well as students and bring advance courses in line. Preparation of manpower that is capable to perform the task adequately in vocational domain is a typical challenge in itself. Formal education which still focused on inside classroom study pattern doesn't offer on demand and competent environment for teaching learning community. On the contrary vocational gap identification is done to resolve the challenge by development of LRs and its dissemination.

These are the visible learning gaps a teacher finds with the content/topic

- Content available is redundant and obsolete/ contemporary material.
- Content is difficult to understand.
- Learning examples and non-examples are not available.
- Cases related to content are not available.
- Innovations related to content are not available.
- Experiment related content are not available
- Content are not available for making project.
- Content is not helpful in developing skills for jobs
- Same tasks is executed through newly evolve technologies

Methodology: This paper present vocational learning gap between industry and academia along with how this gap can be bridge by developing learning resources as per industry requirements. The appropriate method has been chosen to find the gaps of graduates from institute to industry needed manpower. This method focus on how to fulfil Qualification gaps which is addressed by the existing requirement of the industry. In this method need identification approach uses from institute's teacher and industry expert.

The need analysis tool is designed to identify visible gaps those might have encountered while teaching a particular topics or topics in the identified course. Need analysis tool consist of questionnaires after consulted with teachers and experts. A need identification survey is done through Needs Analysis (NA) tool to identify gaps in teaching-learning perceived by teachers was carried out by TLC researchers. Research conducted in various technical institutions and topics having visible gaps were identified. Respondents have also indicated a different type of LRs requirement in the form of video, audio, animation etc to fulfil the teaching-learning gaps. These suggested topics and LRs need further validation from the subject experts as well as industry experts in order to validate visible gaps which can be fulfilled by developed appropriate LRs. various validation workshops has been conducted in this reference.

Trained Trainer Educators and mentors have developed the LRs after validation of topics. Trainer Educators has been identified from technical institutions and mentors from industries.

To identify learning gaps, first stage is to collect data by applying different approaches like conducting seminars, conferences, survey, interview, form filling, orientation workshop, and online form submission.

Data analysis is the next phase after collecting data. Initially collected data was not in interpretable form. Collected data needed to be arranged properly in order to interpret topics and sub topics. Further collected data arranged in tabular form or in such a way that readers can understand and sub topics were arranged in disciplinary manner. The main reason for analyzing data is to bring similar data within one framework.

After analyzing data next phase is to identify visible learning gaps that has been emphasised in need analysis tool by domains experts. Identified visible learning gaps were validated in two phases. Initially validation has been done from academia experts and later on revalidated from industry experts in order to meet appropriate industry requirement. Validation involved opinion of experts from industry as well as academia to enrich LR content that is in development stage that should cover concurrent issues and challenges in Industries.

The content of the LR modules are to be clear, simple, understandable, updated and meet with global industrial requirements.

Implementation:

- 1. Identification of vocation specific gaps through need analysis tool
- 2. Creating a group of subject expert and industry expert and mentors from institutions & industry.
- 3. Vocation specific gaps validation and uses them to develop useful learning resources (LRs) with the help of trained experts from institutions and industry and mentors.
- 4. Disseminate developed learning resources to students and teachers. The Learning Resources such as case studies, anecdotes, modules, incidences, stories, animation and videos will be shared to learner including teachers and students.



Flow Diagram of Proposed methodology

Outcome: Industrial growth essentially depends on the quality of manpower and relevant resources available to it. The effective and skilled workforce can only be achieved through structured training and education offerings. The procedures described in the paper are innovated and adapted to find vocational specific gaps that can be aligned in order to satisfy current market necessities. Latest concern like rapid globalization and a paradigm shift in technology are also successfully covered by the processes followed. The outcome of Need analysis is to be used for the development of appropriate learning resources (LRs) consists of modules, training kits, informative videos, modern laboratories, and new course design. A long term goal of a developing nation is also served through learning resources available to generations that cope with universal demands and lead to quality improvement of vocational education. The need

analysis will also be helpful to develop and design new curriculums of Professional studies. Its major outcome can be seen as a capacity building of Teachers and therefore upgrade the quality of teachinglearning. Based on identified topics activities like training of teachers, Faculty development programmes, skill training can be arranged for a purposeful educational gain of trainers and learners. Learning resources dedicated to fulfilling vocational specific gap would also be helpful to generate selfemployment. The whole process can be classified as

- Validated topics in each discipline for the development of relevant LRs
 List of experts who will volunteer to support LRs development
 - Dissemination of developed LRs in the community

4. Major impact on the society can be experienced through the entire performed task. Overall utility is to shape and upgrade the generations of the country through enabling & accessing them cutting edge technology. LRs will remain compatible with the demandable, modern and competent skill set.

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Blogging : A Digital Way to Share Study Material

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Abstract

Blogging is a way to share our ideas, photos and videos to the world through internet. It was originated in 1994 basically as an online diary, but today it has been emerged as a massive platform to share not only personal ideas and pictures, but also the information and even the knowledge. It is very simple to operate but very useful to share the information. We can upload download various types of data on blog, such as text, rich text, image and audio-video etc. Thus, the opportunity of blogging may also be used in education to create and share study material.

I have created a blog named 'Bhasha aur Bhasha prodyogiki' (Language and Language Technology) (url-<u>https://lgandlt.blogspot.com/</u>). It was only an experiment to blogging with single post in 2015. In 2016, 12 more posts were uploaded and the response was speculative. The blog was viewed more than 3000 times in a year. Being encouraged with this response, I started regular updating posts. There are approximately 250 posts on the blog right now and it has received around 60,000 views. This statistics shows the opportunity to provide course-material through blogging and receive great response not only from our students, but also from the entire world in education.

The major points to be considered while blogging are- The process of creating a blog and applying it as a platform to provide the course-material and other information in higher education., The skill to enrich a blog and make it more user-friendly, such as- choosing proper template, dynamic designing with proper measurements etc., The Techniques to make the blog more interactive. Organizing and categorizing the study material as it would be easily accessible to the users etc.

Keywords- internet, blog, blogging, course-material, language technology.

1. Introduction

Internet is one of the most important inventions of later 20th century which has changed the common mankind to digital human race. It has made us free from the boundaries of time and space with respect to storing and sharing of information and knowledge. It is a massive platform that provides the facility for all types of the information, such as- plain text, rich text, image,

audio, video and animations. We can use, share, upload, download any type of data at any time or place through internet with websites, blogs, youtube channels and social media platforms.

Blog is one of the most popular internet platforms today. It was originated in 1994 basically as an online diary, but now a days it has been emerged as a massive platform to share not only personal ideas and pictures, but also the information and even the knowledge. It is very simple to operate but very useful to share the information. We can upload download various types of data on blog, such as text, rich text, image and audio-video etc. The most popular platforms to design and create blogs are following-

WordPress.org, WordPress.com, Wix, Blogger, Tumblr, Medium, Squarespace, Joomla, Weebly and Ghost

Anyone may use one among these above and may start his blogging and share his knowledge with the world.

2. Blog as platform to share Course-Material

Basically the concept of blog was started for the people who want to share their story, passion with the world or want to interact with a community on special ideas. It became popular in very short time. People started blogging in all areas of daily life, such as-hobbies like sports, travel, cooking, fashion designing; experience and thought sharing like business, work, family, marriage, great ideas etc.

Thus, the opportunity to create and share knowledge through blogging may also be used in education to create and share study material. We can easily upload course material and all additional information to a blog and encourage our students to use it. Once an article or post is uploaded to a blog, it is available to the entire world. A lot of researchers are doing this very successfully. I have also created a blog named 'Bhasha aur Bhasha Praudyogiki' (Language and Language Technology, url - <u>https://lgandlt.blogspot.com/</u>). There are more than three hundred posts on this blog right now having more than 60,000 views.

3. Designing an Interactive Blog

Designing an interactive blog is a skill. If some wants to create a blog for academic purpose, he must be concerned about some ideas before starting. An academic blog must be subject specific. The subject area must be specified with the blog and mentioned in blog's name as readers may be clear about the blog's course material and other information. The name of blog

should be short and self explaining. Once the blogging platform and the name of the blog are decided, it is time to design it properly. The main points to be considered in designing the blog are as following-

3.1 Proper Layout

Layout is to decide areas of main content and other things. There are many options to design layout provided by the blogging platforms. Here is the layout options provided by blogger-

Header		
भाषा और भाषा प्रौद्यो। Page Header gadget	बेकी (edir.)
Cross-column		
Total Pageviews Blog's stats gadget		Edit
Cross-Column 2		
sidebar-left- 1	Main	sidebar- right-1
+ Add a Gadget	Blog Posts Blog Posts gadget	+ Add a Gadget

There are many things to be decided in layout as shown in above figure. These are following-

- **Header** Header is the face of the blog. It includes the name of blog, its short description and the blog image.
- **Cross-Column** Cross-column is the area below the header. Here we can use 'Pageviews' gadget and other gadgets whatever we want. The cross-column may be used to show table of contents as following-

सैद्धांतिक भाषाविज्ञान अनुप्रयुक	न्त भाषाविज्ञान भाषा प्रौ	द्योगिकी/प्राकृतिक भाषा संसाधन	(Language Technology/N	LP) कंप्यूटर (Con	nputer) हिंदी भाषा (Hi
डिजिटल हिंदी (Digital Hindi) वि	हिंदी सीखें (Learn Hindi)	प्रोग्रामिंग और डाटाबेस प्रबंधन	(Programming and Databa	ase Management)	विभाग और आयोजन
पुस्तक सूची ई-पी.जी. पाठशाला	ः भाषाविज्ञान बी.बी.सी	. विशेष हिंदी समय (हिंदी सार्ग	हेत्य के लिए) भोजपुरी	विषय सूचियाँ	

• Left and Right Sidebars- There are two sidebars to be used in blog. These are left sidebar and right sidebar. The blog developer may use anyone of these or both of these according to the desired look of the blog. The information about post updates or table of contents may be shown in these bars-



• **Main Area**- The space below the cross-column and the within the left and right side bars is called 'main area'. All the blog posts appear in this area.

The blogger has to decide the area and gadgets in layout. There is also 'Theme Designer' that provides the facility to choose the background, proper layout and adjust background.

Blogger Theme Designer Themes Background Adjust widths Layout Advanced Difference Difference

3.2 Blog Image

The blog must look attractive to the readers. The blog image plays key role to fulfill this purpose. A blogger can use blogs image within the header. The image is considered to be appealing and representing the purpose or specification of the blog. I have used this image on the blog 'Bhasha and Bhasha Praudyogiki'-



3.3 Template

There are some predefined templates provided by blogging platforms. The each template has its special look. These may also be categorized in some categories like simple, dynamic, contempo, notable, watermark, ethereal etc. Some simple and dynamic templates provided by googles blogger are following-



We may choose a good template from these and also customize it to a fine view.

3.4 Link list with Hyperlinks

The blog has its limitations and have very less functions in comparison to websites. We can't use tabs or sub tabs like menu bar to show the categorized information. Without categorization users will be unable to view the posts or articles what they want to see. The facility of 'Link list' solves this issue. Through this facility we can make table of contents like pages and hyperlink the posts in categories. Using link list as table of contents has been shown above. The hyperlinked posts in each category may look like this-



3.5 Most Important Post

There is also a feature named 'most important post'. It can be added to the cross-column or to one of the side bars. It provides the facility to make one post always visible to the readers.

After complete designing, the blog may be looking like this-



4. Popularizing a Blog

Once, the blog is ready, it is time to popularize it. The concerned readers should be informed and encouraged to use the material provided through the blog. There are many techniques to popularize a blog. First of all we have to inform our students about the blog and instruct them to get material from it. Besides this here are some techniques to popularize the blog worldwide-

4.1 Regular posts

A blog needs regular posts. If we have a lot of material to post on the blog, we should not post them at once and stop after that. We may upload an average number of posts every month as the readers may be eager to new posts and watch the blog regularly. This is a good practice from the point of view of search engine too. With regular posts and searches the blog may have its ingress to statistics of search engine.

4.2 Interaction through comments and Emails

A blog for course material is and secondary educational platform. The readers may have their questions and queries about any of the posts. Their queries must be answers within a stipulated time. The facility of comments is a good place to interact with the readers. Comments may be attached to the email-id of the blogger as he may be informed instantly if someone comments.

4.3 Share on Social Media

Social media is playing a fundamental role in sharing our ideas, notions, photos and others to our friends circle and other people. Social media platforms like twitter, facebook and Whatsapp may be used to share the new or important posts regularly with friends and others.

4.4 Review the Statistics

There is facility of statistics in the blog where we can see how many people have viewed the entire blog or the posts. There are many categories of this statistics. We should survey this and find out the most popular posts. Here is one month statistics of most viewed posts of the blog 'Bhasha aur Bhasha Praudyogiki'-

Posts	
Entry	Pageviews
हिंदी की ध्वनि संरचना 16 Nov 2016, 17 comments	380
बी.ए. पाठ्य सामग्री (B.A.) 4 Nov 2018, 2 comments	133
प्रोक्ति विश्लेषण 20 Nov 2017	113
हिंदी में लिंग निर्धारण : एक व्यावहारिक इ 16 Nov 2016, 2 comments	77
सुकरात, प्लेटो और अरस्तु 8 Feb 2019	77
देवनागरी लिपि और हिंदी भाषा (प्रौद्योगि 5 Feb 2019	75
संरचनात्मक भाषाविज्ञान: संक्षिप्त परिचय 17 Mar 2018	58
हिंदी भाषा (Hindi Language) 11 Jan 2018	58
सैद्धांतिक भाषाविज्ञान 26 Dec 2017	56
सामाजिक व्यवहार के रूप में भाषा 27 Sep 2017	52

We may also find out the country wise statistics to look out the viewers of the nation and abroad, such as-

Entry	Pageviews
India	3171
Unknown Region	600
United States	67
Germany	66
Portugal	24
Ireland	23
Turkey	21
United Kingdom	15
Russia	12
Australia	10

5. Generating Income with a Blog

The blogging is not only a way to share the articles and course material with the students but also to share everything we want to share with the world. It may also be a good source of income if once gets popularized. The forbes has enlisted top ten blogs generating the millions of dollars per month. This is following-

- #1 -- Huffington Post: \$14,000,000 per month
- #2 -- Engadget: \$5,500,000 per month
- #3 -- Moz: \$4,250,000 per month
- #4 -- Mashable: \$2,000,000 per month
- #5 -- TechCrunch: \$2,500,000 per month

(etc.)

(source- https://www.forbes.com/sites/robertadams/2017/03/02/top-income-earningblogs/#6fd14cfb2377)

Ads may be added to the blog which generates income. We may contact to the companies and get ads or if the blog is popularized and having more than 100 views per day, the Google or concerned blogging platform automatically provides ads for this. Google's policy is that once you have generated 100 dollars, it will be transferred to the given account. This facility is called 'Adsense' and looks like this-

= 🌈 Google AdSense	Home			
🔒 Home				
Ads	Estimated earni	ngs		:
E Sites	Today so far \$0.00	Yesterday \$0.00	Last 7 days \$0.06	This month \$0.18
		+\$0.00 vs same day last week	▼ -\$0.05 (-45%) vs previous 7 days	▲ +\$0.18 vs same period last year

6. Concluding Remarks

The internet is an open platform to share information and knowledge. There are many ways to share ideas and information through internet, such as website, blog, social media channel etc. Blog is one of most important way among these. We can use blog as platform to share study material and other information not only with our students but with the whole world. With a good design, regular posts, interaction through email and other required mediums may make it a marvelous educational platform. It is not only free of cost but also a sparkling way to generate income through ads.

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- <u>https://startbloggingonline.com/blog-platform-comparison-chart/</u>
- <u>https://www.incomediary.com/50-top-bloggers</u>
- <u>https://www.wpbeginner.com/beginners-guide/how-to-choose-the-best-blogging-platform/</u>
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Teaching and Learning in CBCS: Matter and Prospects

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Abstract: The Higher Education in India was given a new direction when the Choice Based Credit System (CBCS) was introduced in 2015. Since its inception, it has been receiving mixed reviews from academia. A framework which has been the strength of education systems of a number of developed countries has not yet been accepted whole-heartedly in our country. While the majority of the universities realized the worth of CBCS and brought it to effect, others found some issues regarding the practicality of CBCS and have abstained from it or are in the process of implementing it. Different stakeholders of this field, such as the ministry of education, administration, educationalists, and researchers have varied opinions about CBCS. However, it is the teachers and the students whose opinions matter the most as they are the closest subjects to deal with the implementation and its consequences. In this light, a preliminary survey was conducted in Aligarh Muslim University (AMU) involving the teachers and students. A number of questions were asked regarding their opinion and experience of teaching-learning in CBCS. Attempt has been made to consolidate these points in presenting the current scenario of CBCS and the prospects.

Keywords: CBCS; higher education; teaching-learning; guidelines of UGC

Introduction

The purpose of education is the all-round development of individuals and therefore, it undoubtedly plays a significant role in the progress of a nation. The organizations involved in the planning and implementation of the educational policies play a still higher role. Policy makers keep into consideration various factors ranging from affective to experiential and economic to beneficial to devise educational policies. University Grants Commission (UGC), the authority in charge of higher education in our country has been for years bringing in innovations to be in line with modern pedagogy. Some of these innovations are semester system, continuous evaluation, innovative interdisciplinary courses, grading system, Choice Based Credit System (CBCS) and others.

UGC, the statutory body in the country is responsible for the coordination, determination and maintenance of standards of higher education besides providing recognition to universities in India and allocating funds to the recognized universities and colleges. It has deliberated upon issues pertaining to globalization and internationalization of education from time to time. It has raised issues of quality; modes of supply; access and equity in higher education. In order to discharge its

primal function of coordinating and maintaining standards of higher education, the UGC has been coming up with a wide variety of educational reforms. One of the purposes behind such reforms is to establish higher education of India on an international level equivalent to developed nations.

The University Grants Commission (UGC) under the XI Plan made it compulsory to implement Choice Based Credit System (CBCS) in all undergraduate (UG) and postgraduate (PG) courses across the country from the academic year 2015-16. The implementation of CBCS is in line with the objectives of 12th Five Year Plan of providing equal opportunities for quality higher education to ever-growing number of students along with crossing international benchmarks of excellence and extending the frontiers of knowledge.

Choice Based Credit System allows for a departure from the single-discipline approach in higher studies by providing the students choices of courses from different disciplines. Also, it gives the freedom to complete the course at one's own pace with the help of credit transfer. CBCS thus aims to provide an opportunity for students to have a choice of courses or subjects within an educational program with the flexibility to complete the program by earning the required number of credits at a pace decided by the students. However, since its inception it has been receiving mixed reviews from the academia. It has been analyzed, judged, criticized and talked upon on various grounds. Before coming on to the implications of CBCS in India, it becomes pertinent to get a detailed understanding of its salient features.

CBCS: A Review

According to Chaubey (2015) CBCS can be considered the mother of learner-centric educational reforms. It aims to provide a highly rich learning environment along with flexibility and freedom in learning. CBCS allows students to move beyond the boundaries of an academic discipline and enables them to get the insights of several disciplines. It is activity oriented and focuses on the autonomy of the learner by giving the learner an authority over his/her own education. The availability of choices among different courses and the provision of transferability of credits along with freedom of completing a course at one's own pace make CBCS a 'cafeteria approach'.

The UGC guidelines on Choice Based Credit System lay down different guidelines for the adoption of CBCS. Focusing on the salient features of this system provides a better understanding of it. The principle aim behind implementing CBCS is to unify the diverse education system in the country in terms of examination, evaluation and grading system. It calls for a centralized syllabus framework for the courses, with universities being allowed just 30% deviation while preparing the syllabus. Also, the idea is to devise a sensible system for awarding the grades based on the performance of the students. This will ease the difficulty faced by the acadamia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades. Eventually this will facilitate the mobility of students across different institutions in the country as it will be applicable to all the undergraduate and postgraduate courses across the Central, State and Deemed to be universities of the country.

Semester system is followed under CBCS where one academic year comprises of one odd and one even semester. The different courses in CBCS are Core, Elective and Foundation. A Core Course is the course which is compulsory for all the students to study in a program of a particular discipline. Elective Course is one which can be selected from a variety of papers which are provided. An Elective course can be 'Generic', 'Discipline' or 'Open' depending upon the nature of the paper.

Generic Elective focuses on those courses which add generic proficiency to the students. Discipline Elective is the one which is chosen from within the discipline being studied by the student and Open Elective is that paper which is chosen from a different discipline. Foundation Courses are also further divided into two types- Compulsory Foundation courses are those which are based upon the contents that lead to the enhancement of knowledge and Elective Foundation courses which are value-based.

The above mentioned courses can be taught through "lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study etc. or a combination of some of these" (UGC Guidelines). Credit is an important part of a course. Each course is assigned a particular number of credits. Credit is "a unit by which the course work is measured" (UGC Guidelines). Also, it determines the number of hours allocated to a particular course in a week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

Regarding examination and assessment UGC has given guidelines about a uniform grading system. A 10-point grading system has been recommended by UGC where a letter grade is assigned to a particular grade point. The different letter grades and grade points are as follows-

O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

The courses which are non-credit in nature are to be marked 'Satisfactory' or 'Unsatisfactory' instead of the letter grade and this will not be counted for the computation of SGPA (Semester Grade Point Average) or CGPA (Cumulative Grade Point Average) which is calculated on the basis of grade points gained.

CBCS lays emphasis on the continuous and comprehensive evaluation. It gives 40% weightage to the internal assessment and remaining 60% to the final exam. Internal evaluation consists of one test for 20 marks, one assignment for 10 marks and 10 marks,(5 marks each) for active participation in the class and for over all conduct of the learners during class hours (Hasan, 2016).

The Choice Based Credit System can be compared to those systems being followed in the developed nations. In European countries it is called the European Credit Transfer System (ECTS), in Australia it is called the National Qualifications Framework, and in the United Kingdom it is called the Credit

Accumulation and Transfer System (CATS) (Chaubey, 2015). It can be said that CBCS in Indian higher education is brought to effect in order to bring in the element of liberalization and globalization in education. The whole idea of providing students with choices in academics and giving them the freedom to complete the course at their own pace and also to avail courses from different institutions goes in line with liberating the educational system.

Implications of CBCS

CBCS was indeed a big step in India's higher education. It was not just a change in the nomenclature but also a significant shift in the educational practices. According to a newspaper report of March 2015, 18 UGC-funded Central Universities had introduced CBCS at both undergraduate and postgraduate levels ("18 UGC-funded", 2015). Another report reveals that by July 2015 all the central universities had agreed to implement CBCS in their UG and PG courses but in phases according to their ease of implementation ("All Central Universities", 2015). Despite initial reluctance Delhi University (DU) also implemented it. Many universities and autonomous institutions such as the Mumbai University had implemented CBCS before, in 2011 (Kelkar and Ravishankar, 2014). Some of them are adopting the system at their own pace. CBCS in Goa was to be implemented in the academic session 2017-18 at the undergraduate level, although it has already been implemented at the postgraduate level ("Choice-based credit system", 2017). A call for implementation of CBCS in all the universities of Bihar was made by the then Governor-cum-Chancellor Ram Nath Kovind in the larger interest of the students in May 2016 (Mishra, 2016). In Calcutta University it will be implemented from the next academic session ("Calcutta University to implement CBCS", 2018).

The call for implementation of CBCS by UGC received mixed reviews from different stakeholders of education. While majority of the institutions realized the worth of CBCS thereby, bringing it to effect, others found some issues regarding the practicality of CBCS. The earliest reviews on CBCS taken from students of Delhi University colleges and Jamia Milia Islamia by students' association bodies such as Students' Federation of India (SFI) and All India Students' Association (AISA) show their dissent towards CBCS. According to a newspaper survey ("93% of DU students", 2015) over 91% of the 12000 students at DU alone said a no to CBCS. A most recent report by the West Bengal Government College Teachers' Association (WBGCTA) on the question of implementation of CBCS reveals that without proper infrastructure and adequate number of human resources the systematic functioning of the CBCS curriculum is not possible (India Today Web Desk, 2019).

SURVEY

Teachers and students are an integral part of higher education system and valuable stakeholders. They are the ones at the giving and receiving end of CBCS; the closest subjects to deal with the implementation and the consequences. Keeping this in mind a survey was done at Aligarh Muslim University (AMU) involving students from various departments, majorly from Department of English and teachers of Department of English. The present study analyses their opinions, issues and suggestions recommended regarding CBCS.

The survey involved collecting data by administering a two part questionnaire which was both quantitative and qualitative in nature. The quantitative part was evaluated on a five-point grading

scale and the responses of the qualitative part were consolidated into points. 15 teachers were given the questionnaire out of which 12 responded. 36 responses out of 50 came from students.

Findings of Teachers' Survey

The quantitative part of the teachers' questionnaire was related to the attainability of the objectives of CBCS; examination system; evaluation system; load on teachers; teacher's autonomy in CBCS; prospects of quality of higher education in India (HEI) and relatability with higher education system (HES) of abroad.

Figure 1 shows that 50% teachers believe that the objectives of CBCS are attainable, 16.67% felt they are unattainable and 33.33% were uncertain. While majority of them (58.33%) were satisfied with the evaluation system, only 50% were satisfied with the examination system. 33.33% teachers were dissatisfied with both the examination and evaluation systems. Quite a few of them (41.67%) agreed that the load on teachers has increased and 58.33% teachers agree that there is teachers' autonomy in CBCS. However, when asked if CBCS will help improve the quality of HEI in the long run only 33.33% believed it will, 16.67% felt it won't and rest were uncertain. They were also asked if they could relate CBCS with the HES followed in some of the developed countries such as US, UK and Australia, 50% disagreed and 41.67% agreed. In the end teachers were asked if they found the earlier semester system better than CBCS 66.67% disagreed to it and only 16.67% think that the earlier system was better.



Figure 1 Findings of Teachers' Survey

In the qualitative section of the survey teachers were asked about the hindrances in achieving the objectives of the CBCS. Majority of them found time an important factor. Not enough teaching periods are given for some of the papers. There is non-uniformity in the syllabus. Some papers have a vast syllabus, others have very little. Most of the teachers pointed out that students-teacher ratio was a major hindrance in achieving the objectives of the CBCS. Lack of infrastructure too is a big factor. Other hindrances included irregularity of students, lack of alternative assessment and slow acceptance among teachers. Some of the teachers also considered lack of adaptability in both teachers and students a hindrance in achieving the objectives of CBCS.

Teachers were also asked to mention the strategies they use to cope up with the syllabus. Most of the teachers make use of alternative assessment as a strategy of teaching including assignments, presentations, projects, quiz, etc. Some of them also give application and activity based tasks. Others pointed out at collaborative learning, discussion based, lecture method and giving handouts of material. Some of them also try material adaptation for students of different lexiles and training students in self-directed learning.

At the end of the questionnaire teachers were also asked to give some suggestions regarding CBCS. Majority of them pointed out that there is a need for clarity of the fundamentals of CBCS to both teachers and students. Syllabus needs to be modified in accordance with the new system. There is a need to seriously work upon the infrastructure and reduction of teacher-student disparity. Other suggestions included reduction of workload of students and teachers and reconsideration of examination pattern.



Findings of Students' Survey

Figure 2 Findings of Students' Survey

Out of the 36 responses of students' survey, 5 were from Department of Management, 2 each from Department of Education and Geography and rest 27 from Department of English. The quantitative part of the students' survey was related to the purpose behind the guidelines of CBCS; facility in terms of choosing subject of choice; uniformity in HEI brought about by CBCS; required modification in the guidelines; preference of earlier system and relatability with HES of abroad.

Figure 2 shows that 41.67% students agreed to knowing the purpose behind the guidelines of UGC regarding CBCS, 30.56% disagreed and rest were uncertain. Around 66.67% students agreed to CBCS providing them facility to choose their subject of interest. Only 5.56% disagreed to having a choice and rest were not sure about it. When asked if CBCS has brought uniformity in HEI at various levels of curriculum, grading system and quality of education only 31.94% students believe that it has brought uniformity at some or the other level and 22.22% disagree to it. While 41.05% students believe that the guidelines need modification in terms of evaluation system, syllabus and choice of elective papers, only 8.02% disagree with it and rest were uncertain. When asked if they find the earlier annual system better than CBCS majority of them (52.28%) disagreed and only 16.67% agreed to it. Similarly when asked about earlier semester system only 38.8% found it better than CBCS, 25% disagreed to it and rest were uncertain. They were also asked if they could relate CBCS with the HES followed in some of the developed countries such as US, UK and Australia, 33.33% agreed and 30.56% disagreed.

In the qualitative section of the survey students were asked about the problems they faced in CBCS. The issues that came to light on analysis were related to syllabus, assessment, recommended books and grading system. Students pointed out that due to lengthy syllabus they get little time for self study or extracurricular activities. There is a lot of assessment that happens but little or no feedback is given. Moreover, the recommended books in the syllabus are not efficacious and most of the time unavailable. There is also a lot of confusion regarding the grading system among students.

At the end of the questionnaire students were asked to give some suggestions regarding CBCS. Majority of them pointed out that there is a need to manage the syllabus according to the new system and also the number of periods assigned to each paper. They demanded for a more transparent grading system. Students also proposed for inclusion of more electives and recommendation of suitable material and their availability.

Summary

The preliminary survey done at Aligarh Muslim University regarding CBCS can be summarized into following points-

- The survey shows a hint of confusion prevailing among the teachers and students regarding the attainability of the objectives of CBCS.
- Clarity of the fundamentals of CBCS among teachers and students is a pre-requisite.
- There is a need for teachers' counseling directed towards adaptability of the norms of CBCS.
- There is a need to bring uniformity in the syllabus and accordingly allotting number of periods to each paper.

- Teacher-student ratio needs to be reduced.
- More options regarding the electives should be made available.
- Proper material needs to be made available to the students.
- Students should be given regular feedback regarding their performance.
- Also, there is a need to work on the infrastructure.

Conclusion

This paper has delved into a part of the much talked about educational reforms of recent years, Choice Based Credit System- the implications of CBCS, the current scenario and the prospects. Educational reforms are brought about as per the requirement and efficiency of higher education in a country. Choice Based Credit System is not so old a proposition of UGC. In spite of being formally introduced in the year 2014 it is still facing the question of implementation and relevance. The present study tries to bring to fore front the implications of CBCS and the way it has been received by various educational institutions of the country, particularly AMU. Although implemented by many universities and colleges there are institutions which have not yet adopted it or they are in the process of implementing it according to their ease.

This study also emphasizes the salient features of CBCS that focus on an improved quality of higher education in the country. From a theoretical point of view CBCS is par excellence as it focuses on a holistic development by providing choices to move beyond the boundaries of varied academic disciplines and also to cover them at one's own pace without any restriction of 2 or 3 years. Also, it is a great move towards learner-centered education system which provides autonomy to learners over their studies.

However, the present study also reveals that there are some practicality issues regarding the implementation of CBCS as experienced by various educational institutions due to lack of adequate facilities in terms of teaching faculty and infrastructure. AMU, although being one of the earliest universities to implement CBCS, is not yet fully adept with the system. A number of teachers at the Department of English think that the objectives of CBCS are attainable. However, there is a serious need to work on the syllabus, time management, teacher-student ratio and examination and evaluation system. Students on the other hand find the syllabus lengthy and less time for self study. There is a problem of appropriate material for study and its availability. Also, students are not much satisfied with the grading system.

Considering either side of the argument it would be too early to make any judgment regarding the relevance and efficiency of CBCS. No doubt it promises an enhanced quality of higher education in the country, but at the same time there may be a need of detailed of home work to be done before implementing it in specific educational institutions.

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Appendix

Figure 1- Findings of Teachers' Survey Figure 2- Findings of Students' Survey

Assessing Students' Achievements of a Course: Roles and Responsibilities of Higher Education Teachers

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ABSTRACT

Assessment is an indispensible component of a course curriculum. It guides students to know about their strengths and weaknesses of the course contents. It does not only motivate and encourage students to learn subject contents but also enhance their learning. It provides feedback to course teachers about the instructional design and effectiveness of the course. With this background, this paper critically examines criterion-referenced and norm-referenced assessment and importance of providing feedback on students' performances. Thereafter, it discusses higher education teachers' responsibilities towards students in particular and society at large.

Keywords: Assessment practices, Higher education, Feedback, Students' performances, Teachers' Responsibilities.

The term 'assessment' has multiple interpretations in the Higher Education (hereafter, HE) settings. In this paper, I define "assessment" as "judging students' assignment responses by awarding them score/mark along with qualitative feedback about the quality and extent of their achievements of a course unit" (Sethy 2012). Assignments are of different types, such as, quizzes, term papers, field visit reports, etc. course teachers, in the HE set up, perform two important tasks among others. They teach to students, and award them marks/grade by assessing their achievements of a course.

Course teachers while assessing students' performances gather reasons for students' good and bad performances, and receive feedback about the course that he/she is teaching. Macfarlance (2009) conveyed that course teachers in HE should nurture the academic and personal growth of students and act as a judge of their own success as teachers (p.69). Hanna and Dettmer (2004) vehemently expressed that assessment is the way course teachers gather data about their teaching and students' learning. It refers to the process of obtaining information about students' learning, progress and achievements.

Assessment provides a fundamental analysis of the role and purpose of teaching instructions in the course curriculum and suggests how change can realistically be managed without compromising standards. Assessment is carried out in HE set up mostly for three purposes.

- i) To enhance students' learning,
- ii) To certify students' achievements, and
- iii) To impart quality education.

Assessment collects data about the extent to which objectives of the course are achieved (Yorke 2005; Nicklin and Kenworthy 2000; Brown et al. 2006). It does two

duties; ostensive duty and tacit duty (Boud 2000). The former expresses about the measurable growth of students' and teachers' involvement in a course (Worth-Butler et al. 1994). The latter guides students for their overall growth, which are not measurable, but conceivable and realizable. For example; values, attitudes, personal dispositions, etc. of students.

Assessment influences students' learning. Biggs (1987) and Higgs (2003) state that students' approaches to learning are linked with course curriculum and teacher's assessment of their performances. Broadly, there are three types of approaches to learning found in HE set up; deep, economic, and surface. "A deep approach to learning is expected to ensure that students have a more comprehensive grasp of the subject being studied" (Howie and Bagnall 2013: 389). In other words, a deep approach to learning is one "where students engage meaningfully with the subject matter and treat the course contents as something worthy of their taking the time to get to know and understand" (Howie and Bagnall 2013: 390). A surface approach to learning expects students to learn subject contents merely to pass in a course and fulfill the minimum requirements of a tertiary learning programme (Biggs and Tang 2007). Surface learners have an intention to complete the learning tasks with a little personal engagement, and perceive the tasks as an unwelcome external imposition (Trigwell and Prosser 1991; Entwistle et al. 2001). Deep learners, in contrast to surface learners, have an attitude and intention to understand subject contents meaningfully and clearly. This approach is related to high quality learning outcomes (Entwistle and Ramsden 1983; Trigwell and Prosser 1991). Regarding economic approach to learning, students' intentions are to achieve the highest possible grades by using well-organized and conscientious study methods and effective time management skills (Entwistle and Ramsden, 1983; Entwistle et al. 2001).

Assessment is a continuous process and has six components, where one component follows the other and frames a picture of a wheel. The components are:

A: Establishing learning objectives

B: Providing learning opportunities

C: Assessing students' learning

- D: Providing appropriate qualitative feedback
- E: Monitoring the progress of students' learning
- F: Using the results for future use

Hounsell (2007) summarizes "assessment" in the following passage.

"Assessment is called upon to be rigorous but not exclusive, to be authentic yet reliable, to be enacting while also being fair and equitable, to adhere to longestablished standards but to reflect and adapt to contemporary needs, and at one and at the same time to accommodate the expectations not only of academics, their students and the university in which both are engaged, but also of government and government bodies.....employers, professional and accrediting organisations, subject and disciplinary associations, parents, and the public at large" (p.1).

Assessment is about consistently reviewing and reflecting on current practices of students so as to enhance their learning experience. It is also widely acknowledged that assessment frames learning, creates learning activity and orients all aspects of learning behaviours (Bryan and Clegg 2006). It aims to:

- i) provide useful and on-time feedback to students.
- ii) enhance students' learning experience.

- iii) offer quality education to students.
- iv) enhance course teachers' performance in a course.

Assessment is of two kinds; formative and summative. The primary objective of formative assessment (FA) is to monitor students' learning and provide them feedback for the enhancement of their learning, whereas summative assessment (SA) aims to evaluate students' learning by awarding mark/score without providing feedback to their performance. SA sums up the achievements of students of a course or a programme. According to Boud (1995), SA is the 'final language' students receive in the form of mark sheet. Contrast to it, FA encourages students to develop their ability to achieve the course objectives. It is achieved through a continuous assessment. Greenwood et al. (2001) conveyed that assessment is formative so long as its purpose is achieved, i.e. forward-looking and aiming to improve students' future learning. Yorke (2008) viewed that "FA is dialogic, conversational in intent, seeking to engage the students in identifying ways in which performance can be improved and acting on the enhanced understanding" (p.12). However, some assessments can be treated as both formative and summative. For example, formal class guizzes of a university, where students get feedback for their quiz performance that is treated as FA. Along with feedback they also receive score/mark for their performance which counts to generate the final grade of the students in a course that is considered as SA.

Yorke (2001) conveyed that FA is of critical importance to student learning (p.115). It contributes to students' development and retention in HE system. It is an ever-changing phenomenon that does not work as a recipe; rather a theoretical understanding of assessment is required for course teachers to encourage students in their learning and thereby retaining quality in HE settings. Unlike SA, FA has an advantage for student community, i.e. a dialogic exchange can take place between students and course teacher in reference to the feedback given on assignment responses. In this regard, Yorke (2001) wrote, "Without meaningful FA, academic integration and hence students' retention is put at risk" (p.121).

To assess students' performances of a course, course teacher-cum-assessor needs some frameworks. If a course teacher judges a student's performance in comparing with his/her classmates' performances, it is called norm-referenced assessment (NRA). In contrast to NRA, if a course teacher- cum-assessor judges students' performances with reference to the achievements of course objectives then it is treated as criterion-referenced assessment (CRA). In case of NRA, a student may not achieve all the objectives of the course, yet he/she can be judged as best performer of a class, as his/her classmates do not even achieve the minimum objectives of the course as he/she has achieved in his/her performance. So, without even achieving all the objectives of the course, he/she could stand first in the class. In NRA, mark sheet of a student is generated through 'bull-curve'. Mark sheet generated through 'bullcurve' is relativistic, subjective and not pragmatic in nature. Further, in NRA, course teacher-cum-assessor's expectations from the students are also entangled while assessing students' performances. NRA, therefore, does not convey students' achievements of a course in true sense. In NRA, course teachers may manipulate students' mark sheet by adopting a mala fide bull-curve. This does not bring fairness in the assessment practice. This behavior of course teacher-cum-assessor does not support teachers' professionalism in HE set up, as it does not communicate students' real achievements in a course, and therefore misguides students and stakeholders to a great extent.

CRA, in contrast to NRA, is carried out based on students' achievements of course objectives. In CRA, there is every possibility that most of the students in a course score a particular letter grade, say A, or S, etc., as course teachers/assessors are not required to generate mark sheet of students through a 'bull-curve'. So, the mark-sheet generated through CRA is relatively treated as fair, professional and objective to an extent.

Criterion-referenced assessment (CRA)

The increasing use of criterion-referenced assessment in higher education is a consequence of its sound theoretical rationale and its educational effectiveness (Sadler, 2005:176). In this model, scores/marks are assigned to students' performance based on how well they achieve the course objectives in their performances. It justifies the relationship between course objectives, achievements and the marks awarded based on their performance (Sadler, 2005:179). CRA assists the course teachers/assessors to provide a rationale for awarding a letter- or number-grade to a student. In this regard, Biggs (1999) expressed that in CRA, a correlation exists among course objectives, teaching and learning activities, and assessment tasks.

Norm-referenced assessment (NRA)

NRA represents students' achievements of a course on a bull-curve, where the score of a student is compared with his/her classmates in the class. It may not have link with the students' achievements of the course objectives. Even without achieving all the course objectives, a student's performance can be judged as best in comparison to his/her peers' performances. Here, the assessor is not assessing students' performances based on what the course demands, but on the basis of the difference between a student's performance and his/her classmates' performances. NRA is known for its 'percentage score'. The cut-off marks/scores for each letter grade (say, S, A, B, C, D, E, and U) of a grade scale, say 5 or 7, are not usually linked to the mastery of specific subject contents or skills.

Shortcomings of Norm-referenced Assessment

NRA is not free from lacunae. In NRA, course teachers determine cut-off marks for an assignment arbitrarily. The cut-off marks often depends on course teacher/ assessor's attitude and values of the course he/she teaches. Other drawbacks are ambiguities regarding, how is cut-off mark generated in the first place before spreading the marks on a bull-curve, how to determine cut-off marks for a letter grade say, S or A etc.? Further, if most of the students receive, let say, A grade in a course then why do course teachers need to pull some students from A grade to a lower grade to design the bull-curve?

In case of NRA, students' performances are compared, which is not free from teacher's subjective and biased notions on students' performances. In this way, NRA gives ample scope to the course teachers to tamper with the students' mark sheet ruining the quality of education. Tampering with mark sheet has repercussions, i.e. students will not be able to know where they stand in terms of knowledge on a course and an employer will be misguided if he considers the face value of marks received in a course. In NRA, students' failure rates are typically lower than the pass rates, as the course teacher/assessor generates the mark sheet of students by using bull-curve that suits him/her. Thus, NRA does not convey what level of knowledge students

possesses of a course.

According to Roberts (2015), a score/mark must necessarily indicate something about a student's knowledge of a subject for which the score is given. The score communicates a student's knowledge and understanding about a particular subject (p.12). Since NRA entangles with score pollution, it is treated as a violation of teachers' professional ethics with reference to assessment practices. An inflated score is a misrepresentation of students' performance. It communicates a false information that is harmful to both students and teaching profession, and thereby to the society (Kamber and Biggs 2002; Corlett 2005: 37). Biggs stated that score pollution on students' performance is harmful to society (Biggs 2008: 115). When course teacherscum-assessors inflate scores, it wrongly communicates information to society that students are better prepared for a task/job than they really are. Inflation of scores also misguides decision-makers who are considering students for different positions. Thus, score pollution/score inflation is unethical. American Association of University Professors (AAUP) on Teachers' Professional Ethics mentioned that "professors make every reasonable effort... to ensure that their evaluations of students reflect each student's true merit" (Roberts 2015:13-14). According to Woolf (2004), "assessment entails course teachers making professional judgments about the standards and quality of students' work" (p.479).

In CRA, it is theoretically possible that most of the students of a course can score a particular grade, lets say 'A' grade, if they achieved the intended learning outcomes. But the "validity of CRA depends upon the precision with which the criteria are stated and applied" (Yorke 2008: 18). Hornby (2003) believes that CRA should be given the priority to offer quality education to students in HE system. This framework of assessment indicates a student's level of knowledge in a course, their knowledge about the subject contents, as assessment scores are awarded in correspondence with the achievements of course objectives. Thus, CRA assists stakeholders to know the merit of a student with reference to a course. Since CRA is fulfilling the three purposes of assessment (learning, certification, and quality assurance) as stated by Yorke (2005/2008) and Nicklin and Kenworthy (2000), it is judged as "professional assessment practices".

Assessment practices evolve with time. It is truism that learning requires feedback. Without feedback, assessment has hardly any role to play in students' learning. Gibbs (2006) said that students require more support in the form of assessment feedback on their progress and guidance about how to focus on course contents and learn them creatively. Chickering and Gamson (1991) mentioned seven principles of providing feedback to students to enhance their learning which is endorsed by Nicol and Macfarlane-Dick (2004), and Nicol and Milligan (2006). These seven principles need to be adhered to by course teachers/assessors while assessing students' performances. Only then teachers' assessment practices would be treated as a professional activity. These principles are;

Principle-1

Assessment feedback should clarify students what good performance is, by informing them the goals of their study, criteria of evaluation and expected standards. Palloff and Pratt (2005) conveyed that students could regulate their learning and set their goals if they comprehend the standards and criteria that define goal attainment.

Principle-2

Assessment feedback must facilitate students to engage in learning through selfassessment. Falchikov (2005) said that there has been an increasing interest in selfassessment in HE. Sadler (1998) reported that the intention of formative assessment should be to equip students gradually with the same evaluative skills that their teachers possess (Bryan and Clegg 2006:66). Boud (2000) said that a key principle behind self-assessment and self-regulation is that students are involved both in identifying the standards that apply to their work and in making judgments about how their work relates to these standards.

Pinciple-3

Assessment feedback is expected to communicate unambiguous information to students about their learning so that, students are not misguided about their learning. For example, "work a little hard, you will do good!". This is an ambiguous feedback which does not communicate anything to the students clearly. Wiggins (2001) expressed that unambiguous feedback helps students to understand the gap between the current performance and the goals that need to be attained.

Principle-4

Assessment feedback must establish peer dialogue among students about their learning. If teachers give feedback, students much study that and implement in their learning context. In the process, students get an opportunity to discuss the feedback among them and put an effort to rectify their errors for future learning endeavor. Nicol and Boyle (2003) prescribed classroom communication system (CCS) as a tool that can be used to enhance dialogue among students on their feedback. This tool also helps to establish a dialogue between teacher and students. Hence, learning of students and teachers on a course content is enhanced.

Principle-5

Assessment feedback encourages students and accelerates their self-esteem towards learning. Black and Wiliam (1998) mentioned that feedback could have a positive or a negative impact on students' motivation towards learning. So, teachers should be cautious and courteous while writing feedback on students' assignment responses. The notion of 'sandwich feedback' is reckoned in this context. Sandwich feedback says, course teachers-cum-assessors should begin by commenting on strengths of a student's performance, moves on to discuss weaknesses, and rounds the comments off with encouragement for the future" (Yorke 2001:123). Rogers (1961) said that quality feedback is of critical importance in the promotion of student's learning.

Principle-6

Assessment feedback merges the gap between students' current and desired performance. Nicol and Milligan (2006) said that feedback must close the gap between the current learning achievements of the students and the goals set by the course teacher (p.72).

Principle-7

Assessment feedback must guide course teachers to analyze whether they need to modify the teaching strategies that include instructional design and delivery pedagogy of a course. Yorke (2003) emphatically expressed that the act of assessing has an effect on the assessor as well as the student. Nicol and Milligan (2006) further viewed

that, "In order to produce feedback that is relevant and informative, teachers themselves need good data about how students are progressing (p.73)." Yorke (2003) vehemently expressed that while assessing students' responses teachers learn about the extent to which students have learned the subject contents and accordingly tailored the teaching, if required.

Integration of technology in assessment practices is not a new phenomenon for both students and teachers of HE settings. In the technology enabled assessment practices, if all these seven principles are adopted, students will be highly benefited and the purpose of assessment will be fulfilled. As a result, quality in HE can be ascertained and students' attrition can be reduced.

Feedback provided on students' performances could be broadly classified into five types (Nicol and Milligan 2006:84).

- i) Comments on contents of student's performance
- ii) Comments designed to develop student's skills
- iii) Comments that encourage students' further learning
- iv) Motivational comments on student's performance
- v) De-motivational comments on student's performance. So that students will avoid incorporating the unwanted matters in his/her performances.

HE teachers, therefore, must learn about these feedbacks while assessing students' performances. These feedbacks need to be provided on students' performances from personally, globally, and standard perspectives (Gibbs et al. 2003; Nicol and Macfarlane-Dick 2004; Brown and Glover 2006). With these feedback practices, professionalism in assessment can be asserted and confirmed.

Gibbs (2006) said that the importance lies on feedback when students engage on it and try to find out the ways and means on how to improve further in their learning. Higgins et al. (2000) said that if students are not interested on the feedback, then feedback does not play any role in their learning. The challenge lies with course teachers as to how to motivate students to study the feedback provided on their performance? Gibbs (2006) reiterated that, feedback that focuses on student's overall performance in the form of a mark/score detracts them from learning. The reason is, students may not be able to know why a particular score is awarded to them. So, course teachers/assessors should provide feedback on students' performance either without assigning marks or marks with feedback. As a consequence, students will be able to read the feedback and use the feedback for their future learning endeavours.

In HE settings, what is required is more learning, not more grades. Gibbs and Simpson (2004), and Nicol and Macfarlance-dick (2004) mentioned nine conditions under which assessment supports students' learning. These are:

- i) Assessment feedback should motivate and encourage students to put their best effort and invest sufficient study-time to learn the subject contents outside the classroom.
- ii) Assessment feedback must guide students to distribute their effort evenly across the curriculum.
- iii) Assessment feedback should help students to engage in productive learning activity
- iv) Assessment feedback must communicate the expectations of the course

- v) Assessment feedback must not be ambiguous. It should be lucid and self-explanatory to students.
- vi) The assessment feedback must be provided on time for students' use.
- vii) Assessment feedback should inform students about their learning rather than marks of their assignment responses alone.
- viii) Assessment feedback should establish a link among course curriculum, criteria adopted for assessment, and purpose of the assignment.
- ix) Assessment feedback should find out a mechanism to inform students whether they attended to the past feedback or not.

Gibbs (2006) said that students' learning is poor in HE settings largely because the assessment system does not work well. Through assessment feedback, course teachers can empower students to self-regulate their learning. Sadler (1998) expressed that formative assessment is specifically intended to provide feedback on students' performance to improve and accelerate their learning (p.77). Assessment feedback can be broadly divided into two types; internal and external. Internal feedback is a result of self-assessment practices/exercises. Yorke (2003) and Boud (2000) conveyed that internal feedback is indispensable to the development of selfregulated learning. External feedback is provided by peers and assessors. These feedback focuses on scaffolding students towards greater self-regulation in their learning (p.64).

Roles and Responsibilities of HE Teachers

The role of teachers as professionals in the HE set up is ethically complex and challenging. According to Campbell (2000), the primal objectives of the teachers' code of ethics are to enable the academic profession for public accountability and to provide a framework for sanctions and the disciplining of members. Again, the code of ethics may be used as a resource to deal with ethical dilemmas with reference to assessment practices, and other routine works. In this regard, it is asserted that teachers are accountable to their students, guardians of students, and public in general.

'Responsibility' and 'accountability' are the essential features of professionals. Broadly speaking, professionals have two types of responsibilities; forward-looking responsibility and backward-looking responsibility (Poel 2011). Forward-looking responsibilities are those where course teachers use their emotional intelligence (EI) skills to take appropriate and ethical decisions in a given situation. Sethy (2015) defines emotional intelligence as "skills that subsume self-awareness, self-regulation, motivation, empathy, and social skills" (p.81). Roser (2010) states that emotions like empathy and sympathy could correct the egoistic emotions. So faculty members should critically assess their EI skills and stakeholders' (students) emotions before they take decisions on academic matters. Compassion, benevolence, empathy, etc. are part of forward-looking responsibilities. In contrast to this, course teachers too have 'backward-looking responsibilities', e.g. shame, resentment, guilt, blame etc. Backward-looking responsibilities are known as failed responsibilities. It ascribes negativity towards professional responsibilities. It expresses that some tragic incidents happened in the past due to certain mistakes committed by professionals in their tasks. Professionals should learn from these mistakes and must avoid similar mistakes in their future endeavours. Example of a backward-looking responsibility, let's say, mass faculty members recruitment was done by compromising their qualifications and eligibility criteria by a high-powered governing body comprising of a few faculty members. The consequence of this event was a disaster for the society. From this

event, faculty members (recruiters, recruited, and other faculty members) have learnt that this sort of action ought not be repeated in future endeavour.

Responsibility and risks are interrelated phenomenon, and form a knot. One can't eliminate risk from the responsibility and vice versa with regard to professional tasks. Risk is a constituent of professional activity. Faculty members take risks to invent and discover new ideas for the benefit of students and society. They modify the course curriculum, instructional design, and pedagogical delivery of a course, etc. In the process, they learn what risks are acceptable and what risks are not acceptable to the society. It is said that if a risk has high probability of success and less negative effect, then it is acceptable. But if a risk has low probability of success and large negative impact, then it is not acceptable. For example, changing the assessment pattern of a course in the mid semester is acceptable even though it has risk. But, awarding marks/grades to students without assessing their performance is not acceptable. Risks have two components; risk assessment and risk management. The former expresses about identification and quantification of risks, whereas the later states about acceptability of risks and its societal management. Professionals have six types of responsibility (Heart 2008; Wolff 2006; Ladd 1991).

- a. Role responsibility (Heart, 2008)
- b. Causal responsibility (Heart, 2008)
- c. Capacity responsibility (Heart, 2008)
- d. Liability responsibility (Heart, 2008)
- e. Blame responsibility (Wolff, 2006)
- f. Virtue responsibility (Ladd, 1991)

Role responsibility is linked to a specific position of a profession to which particular duties are assigned. For example, a faculty member is responsible for his/her classroom teaching activities. Causal responsibility refers to the cause understood in a quasi-mechanical sense of an event. For example, frequent power cut causes disturbances in the classroom teaching. Capacity responsibility refers to the capacity of a professional to fulfill his/her responsibilities. Capacity implies possessing knowledge about an action, and being able to control the action with reasoning. An example, a faculty member is responsible for his/her tainted grade sheet (a grade sheet where students' scores are tampered). Liability responsibility is the legal facet of responsibility. In the HE setup, a faculty member is responsible for his/her misbehaviour towards students. Blame responsibility says blame occurs when there is a violation of ethical codes and at the same time one's behaviours/actions are morally culpable. For example, leaking question papers of an examination. Virtue responsibility is a form of responsibility that refers to moral deficiency and not just to fault. It implies the absence of care and concern of professionals while performing tasks. It describes 'how things are and how things should be or should have been'. For example, faculty members' indifference behaviour towards teaching and learning tasks. Here, even if faculty members were not really at fault, quality education would still hamper.

Problems Surrounded with Professional Assessment Practices

The constant evolution of assessment practices in HE system brings some inevitable challenges for course teachers-cum-assessors on various fronts. Some of the challenges are: assessing a group presentation and providing feedback to each and every member of the group, assessing students' performances of a large class and providing feedback to them on time, formulating yardsticks for students' peer assessment, etc.

Often there is gap found between course expectations from the students and the efforts put in by students in a course. To merge the gap, assessment plays a vital role. But unfortunately teachers who teach a large class won't be able to provide feedback on students' responses on time. In this regard, a teacher being helpless and not providing feedback on time to students goes against the teacher's professionalism behavior. In some occasions, it is observed that students read only the marks/scores assigned to their performances but not the feedback (Higgins et al. 2000). So, in this case, assessment plays hardly any role. If students read the feedback and would not work on it, then again, assessment would hardly play any role for enhancing their learning. Rust et al. (2003) said that if students discuss feedback received on their performance in class, they are more likely to think about it and take it seriously. But in a semester programme, course teachers-cum-assessor hardly gets time to discuss students' feedback in the class. In the HE set up, teachers are not only entangled with teaching duty but also research works, supervision to doctorate students, institutional administrative works, etc. There are HE institutions where teaching assistants are recruited to assess students' performances. But unfortunately it is found that their judgments on students' performances are weak and not professional (Palloff and Pratt 2005).

Some faculty members are unaware of how to and what to assess in students' performances, as they have not received training about assessment practices. A few faculty members emulate their teachers for assessing students' performances in an accurate manner, as their teachers were assessing them for their performances without realizing the uniqueness of the course that they are teaching to the students. In some cases, it is observed that some faculty members believe assessment means giving a score to a student's performance. This sort of understanding does not assist in achieving aims and objectives of the assessment practices in HE set up.

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Experiential Learning in Semiconductor Devices and Physics B.Tech ECE Course: Capacitive Sensor

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Abstract—In this article the experiential learning is discussed, which was a part of Semiconductor Devices and Physics subject (subject code ECPC13) for undergraduate Electronics and Communication Engineering (ECE) students under flexible curriculum at National Institute of Technology Tiruchirappalli (NIT-T), Tamil Nadu, India. Students have developed a capacitive sensor, which is a proof of concept matching with their topics "Variable capacitor and MOS capacitor" in the syllabus. The capacitive sensor makes changes in the capacitance depending on the different materials or levels in the vessel. Cylinderical and cuboid vessals are used for capacitive sensing. The tested materials were - milk, water level detection and purity detection. Rice purity detection. Another project done was printable and flexible electronic circuits- it was done with the graphite powder. A simple electronic circuit was prepared on a paper using graphite powder solution as wiring. Since graphite powder is insulator in nature, so a conductive solution was prepared using appropriate binder, simple glue was used for simple binding agent. The thickness of the pasting was a bit wider to reduce the wiring resistance.

Index Terms—Capacitive sensor, experiential learning, printed electronics, undergraduate, engineering, graphite, binder.

I. INTRODUCTION

N most of government institutions in India, today also the emphasis is there on theory rather than exploring the application part for commercialization. So most of the students after their graduation don't even know the simple applications even for a small device. Even a simple sensor is like a black box for them just because they have not done or even thought some such application during their graduation. Because of this they are less confident for starting a new company which can produce even simple electronic products. Thus most of them are ready to become job seekers, which is not good for the country like India, specially, when so much investment and efforts are put on the top central government funded institutions.

At NIT Tiruchirapalli, the subject Semiconductor Devices and Physics (subject code ECPC13) is a 3 credit theory course, which is core course for Bachelor of Technology (B.Tech) degree in Electronics and Communication Engineering. In this subject theory for semiconductor devices like- diode, Bipolar Junction Transistor (BJT), Metal-Oxide -Semiconductor Field Effect Transistor (MOSFET), MOS Capacitor, Variable capacitor diode, circuit applications such as clipper, clamper, rectifiers, display devices- are taught.

ECPC13 was taken in Section A (55 students) by Dr. Menka. This was the first time when the students were given a

project in a theory course, so it took a lot of time to convince the students for the projects. But once they started, many of them were very keen about the project. The projects were given in a group of 2 to 3 students per group. Each set of project were given 10 point for individual students.

Organization of this paper is like this- Section II- is about the products available globally for capacitive sensing, Section III-describes the methodology used for execution of this experiment, Section IV- results are presented and discussed in this section and Section V- concludes the work done.

II. PREVIOUS WORK

Capacitive sensor is not a new thing for researchers and manufacturers. It is already commercialized at micro scale dimensions. But for simple applications those micro dimensions are not required. Even bigger dimensions can give us wanted results, moreover it can be prepared out of lab.

A few of under research capacitive sensors are given herecapacitive pressure sensors at micro scales are discussed in [1, 2, 3, 4], which can be fabricated in fabrication laboratories due to their low dimensions. Capacitive humidity sensor is presented in [5], capacitive power sensor is presented in [6, 7, 8], other type of sensors are flow rate sensor, biomedical sensors, displacement sensors etc. , which are under research and few of these are already commercialized as well.

All of these sensors are fabricated or printing technology is used [1]-[14], both of which are not available for experimental purpose for a number of 55 students at NIT Tiruchirappalli, so the dimensions of sensor were increased, so that a capacitive sensor can be easily prepared out of laboratory at macro level.

III. METHODOLOGY

The students were given instructions for preparing the capacitive sensors. Although this was out of class activity, so most of instructions were given out of class only, which were carried out by the students. All the instructions were sent to the students through Google group (a group email created by the students), therefor it was not compulsory for all students to attend the instruction lectures, which were 10 to 15 minutes, only the students who had doubts can come for instruction class. In first instruction class they were asked to find out the working or implementation of sensor by discussing among group members or taking help from internet. Only those who need some help to understand the theory can meet the instructor for discussion with prior appointment.

After their willingness for capacitor as a sensor they were told the theory for the shapes of capacitors (which is the

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1) Results and discussions:

• Water level capacitive sensor

Apparatus required: Aluminium foil, non-conducting plastic cylindrical can of appreciable diameter, water.

Experimental setup for water level sensor is shown in Figure 3. The relative permitivity of water at DC is 80, so the above mentioned formula in Equation 4, will give exact results.Dimensions of the plastic vessel are like this- Radius = 2.5 cm Height of Aluminum foil used = 10 cm. The results obtained are represented in the below Table II.



(a) Experimental Setup



(b) Practical data plot

Fig. 3. Experimental setup for water level sensor, the practical results is shown here. The graphs were plotted and curve fitting was also done in MATLAB, they obtained the following expression for fitting equations i) Linear fit equation : Capacitance = 0.2404 * x + 55.2015, ii) Quadratic fit equation : $Capacitance = -0.0012 * x^2 + 0.3661 * x + 53.5491$ with more than 92% confidence level

 TABLE II

 The measured capacitance for water level detector

S.No.	Height (cm)	Capacitance (pF)
1	0	53
2	1	58
3	2.5	61
4	4	66
5	5	69
6	6	71
7	7.5	73
8	9	76
9	10	78

• Detecting Percentage of water in Milk Water solution using capacitive sensor

- 1) Materials used and relative permitivitty $\left(\frac{\varepsilon}{\varepsilon_0}\right)$: 1. water = 80, 2.Skimmed milk powder = 2.3, 3. plastic (container) 2.0 to 9.5
- 2) Vessel (cuboid shape) dimensions: height =10.2 cm, breadth =6.2 cm, distance between electrodes =3.1 cm, electrode plate area = $63.24 \ cm^2$.
- 3) Milk-water solution volumes 200 ml, 50 ml (two volumes were taken to validate the results with more data sets)

TABLE III
WATER PERCENTAGE SENSING IN UNKNOWN MILK WATER SOLUTION

S.No.	% Milk	Capacitance (nF), 200 ml	Capacitance (nF), 50 ml
1	Air only	1.165	1.165
2	100	1.176	0.295
3	66.67	1.221	0.308
4	50	1.23	0.31
5	33.3	1.236	0.312
6	25	1.242	0.314
7	20	1.245	0.315
8	0	1.254	0.321
9	Unknown	1.243	0.3145





Fig. 4. Detecting % of milk in milk water solution

Table III represents the data obtained for different milkwater solutions and the Figure 4 represent the data with linear curve fitting with confidence level 92% for 200 ml and 95% for 50 ml. This curve fitting is used to evaluate the % of milk in unknown solution (the last line in the table) and the same is validated with the calculated capacitance values using the parallel plate capacitance formula listed in above equation. The result for unknown capacitance (last solution in Table III) is 20% to 25% of the milk in the unknown solution.

• Other projects done under capacitive sensors

Other projects under this category were - detecting the Gelusil (a medical tonic) level detection, ink concentration detection in water (it was aimed to use for proper dying to achieve exact colour in textile industry), glucose water solution and sugar solution level detection, as represented in Figure 5. Some groups have validated the results with theoretical readings as well.



Fig. 1. Capacitive sensor symbolic diagram for cylindrical shape and parallel plate capacitor, where 'r' is the radius for insulator and 2θ is the separation angle between metal terminals for cylindrical capacitor while 'h' is the length of parallel plate and 'd' is the separation between plate

TABLE I Instructions for students

ſ	S.No.	Work for	Instructions	
		Weeks		
ſ	1	1-2	Re invoking the theory for parallel plate	
			capacitance and submitting the project titles online	
	2	3-4	Extending the parallel plate theory for a cylinderincal shape capacitor and developing a formula for the same	
	3	5-8	Implementing the capacitive sensor project for the material of their choice	
	4	9-10	Instructions for flexible and printable electronics at micro and macro scale	
	5	11-12	Implemeting a simple circuit using Graphite with appropriate binder on a paper using simple resistor, LED, diode, capacitor etc.	
	6	13-16	Evaluation of the projects and finding out what else students can think about similar products. Indirect feedback and outcome checking for the project based learning	

general shape of vessels used for sensing purpose) shown in Figure 1, in their instruction class of 15 minutes.

To provide the complete information to all students, written instruction sets were emailed to the Google group email, time to time. The Table I enlists all the instructions provided to the students. Within two weeks time students were supposed to submit their project title and group (team) member details online through Google Docs, this has helped the students to avoid overlapping of the similar title and it also helped the instructor to give the instant remarks for the title submitted or suggestion for any modification if required by any team.

IV. RESULTS AND DISCUSSION

This section presents the results obtained by the students and discussions for the same.

A. Capacitor Sensor

This subsection discusses only two capacitive experiments due to space constraints in the paper, done by the students for the capacitor as a sensor, which was a compulsory project for the whole class. First experiment is for water level detecting in a cylindrical shape sensor and second experiment is to validate level sensing along with checking for unknown quantity of water in a milk-water solution using cuboid shape sensor.

Theory : The capacitive sensor was having shape of a cylinder or cuboid. used for experiments. The structure was created with plastic vessels. Two metallic foils were pasted on the vessel to work like two terminals of the capacitor. The two dimensional look for sensors used is presented in Figure 1. For a parallel plate capacitor with height 'h', width 'w' and separation between plates with permitivity of the material ε , the capacitance can be expressed as given in Equation 1.



Fig. 2. Capacitive sensor with different liquid level, here 'x' is liquid level, 'h' is height of sensor, 'd' distance between parallel plate, ε - permitivity of the liquid and ε_0 - is free space permitivity

$$C = \frac{\varepsilon . h. w}{d} \tag{1}$$

The level sensing by capacitance change can be understood by the below diagram in Figure 2. Since the metal is same but the permitivitty change is there for 'x' length-liquid- ϵ and '(h-x)' length -air is filled with permitivitty ε_0 . Therefore, the two capacitances can be considered in parallel and the resultant capacitance for sensor C_{sensor} , can be expressed as given in Equation 2 and subsequently in Equation 3.

$$C_{sensor} = \frac{w}{d} \cdot (x \cdot \varepsilon + (h - x) \cdot \varepsilon_0)$$
(2)

$$C_{sensor} = \frac{w.x.\varepsilon}{d} \left(1 + \frac{(h/x - 1).\varepsilon_0}{\varepsilon} \right)$$
(3)

iff the permitivitty of liquid if very high as compared to air i.e. $\varepsilon >> \varepsilon_0$ or if $\frac{(h/x-1).\varepsilon_0}{\varepsilon} << 1$, then the C_{sensor} can be expressed as given in Equation 4, which is a linear function of liquid level 'x'.

$$C_{sensor} = \frac{w.x.\varepsilon}{d} \tag{4}$$

The similar concept can be extended for cylindrical shape liquid level sensor.



(a) Experimental Setup with height of metal 17 cm, for sugar solution and water level





(b) Practical data plot for water level detection, data is validated with theoratical calculation of capacitance



(c) LSugar level detection using capacitive sensor, 5 gram sugar-water solution was prepared with 500 mL water



Varying capacitance on height or sugar weight change

(d) Sugar weight varying with different solution level in capacitor

Fig. 5. Experimental setup for water level sensor, and sugar-water level sensor the practical results with experimental data validation using theoretical concepts.

2) Flexible Electronics: Out of two projects one project was compulsory which was capacitive sensor, another project they were free to choose using any concept from ECPC13 course. Some of them have used MATLAB modeling to create clipper, clapper and diode rectifiers, others have used simple bread board with available basic materials, to showcase the validity of any concept in ECPC13.

Two groups have taken flexible electronics as a project and they have shown the proof of concept, one of them is explained here-

Objective : To design a basic circuit using conductive graphite paste

Materials required : LEDs, Resistor (330 ohm), Breadboard, Jumper wires, Graphite powder and glue mix and 9 V battery

Procedure : Two mixes of graphite and glue are made with different concentrations, the two concentrations bearing the ratio of Graphite : Glue = 75 : 25 and 50 : 50. Basic circuit to switch on an LED is made on the breadboard using jumper wires and battery. However the circuit is not completed using the wires solely. Two thick layers of the graphite paste are made on a cardboard sheet .The open circuit is completed via either of the two layers acting like a conductive path.

Observation : It is seen that the led brightens up when the circuit in completed using layer 1 (75 : 25 ratio) while the brightness reduces to a great extent when the circuit is completed using layer 2 (50 : 50 ratio). This shows the conductive nature of graphite paste which can be further improved upon to create flexible circuits.

V. CONCLUSIONS

The students were given capacitive sensor based project to detect either the level of any liquid or to identify the ration of one substance in any fixed volume solution. They come up with difference ideas at their own and different practical applications. Different types of sensors were prepared using plastic cuboid or cylindrical vessels. The sensors were developed for water level detection, percentage of milk detection in milkwater, sugar -solution height detection, Gelusil level detection, color concentration detection in a solution for textile industry application. Some of the groups has validated the results using the capacitance formula and some of them tried to find out linear fit approximation of the practical data which has given very good confidence level. Some groups found the unknown milk percent in the solution using capacitance and equation of linear fit. Overall it was a good learning for them. Another project carried out was flexible electronics which was carried out by using graphite powder with glue to make it conductive and proof of concept was produced by preparing a circuit on a thin cardboard.

ACKNOWLEDGMENT

This work was done by B.Tech second year- section A, Electronics and Communication Engineering (3rd sem- July -2018) students as a part of their assignment in Semiconductor Devices and Physics (ECPC13) at NIT Tiruchirappalli, India. I appreciate their enthusiasm for a project based assignment in a theoretical subject which was first time in the ECE department of NIT Tiruchirappalli. I extend my sincere regards to the Head of Department Prof. Lakshminarayan for allowing me to keep a project based assignment in the theoretical course. I want to give whole credit of successful completion of this project to the students. I appreciate their commitment and dedication for the projects as a part of assignment.

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Appendix - A

Sharing Teaching-learning Conference (STEC2019)

Teaching Learning Center, IIT (BHU) Varanasi

March 8-9, 2019

Venue: ABLT Complex, IIT (BHU) Varanasi

March 8, 2019, Friday

10:00-10:30: Inaugural Session

Inauguration

Invocation by Shivam Dwivedi

Kulgeet by Prasahnt Priyadarshi

Welcome note of TLC: Prof P Shukla

Concept-note: Dr. Anil Thakur

Remarks: Chief Guest Professor AK Tripathi, Dean, Resource and Alumni, IIT (BHU) Varanasi

Chair: Prof P Shukla, Chair, STEC2019

The Vote of Thanks: Dr. V Ranamathan

Coordinate: Dr. V Ramanathan

10:30-11:00: TEA BREAK

11:00-12:00: Keynote Session

Professor Sundar Sarukkai, NIAS, Bangalore

- Innovation and Interdisciplinarity

Chair: Prof. Nirmalya Guha

12:00-1:00: Paper Session-1

Citizen Science as the New Face of Science Communication and Interdisciplinary Milieu

- Asani Bhaduri & Ayush Shukla (Delhi University)

Pedagogy of happiness: Implications for teaching and learning

- Nargis Fatma & Deepa Mehta (Faculty of Education, BHU)

Teaching-Learning Script, Writing System and Orthography: The case of Urdu

- Tariq Khan (CIIL, Mysore)

Use of flipped classroom in teaching neuroscience to engineers - Student perception and performance

- Varadhan SKM (IIT Madras)

Chair: Professor AK Tripathi

1:00-2:00: LUNCH BREAK

2:00-3:00: Paper Session-2

Blogging: A Digital Way to Share Study Material

- Dhanji Prasad: MGIHU, Wardha

Representation of voices across disciplines: A study of the choice of verbs

- Sanjukta Ghosh (IIT BHU)

Analysis of Scholastic Achievement of class 10 school students in relation to Self-concept and family environment

- Pragya Jha (MATS University, Raipur)

Teacher Training and Use of Multilingual Pedagogy in Rural Bengal

- Dripta Piplai Mondal (IIT Kharagpur)

Chair: Prof. Rajni Singh

3:00-3:45: Invited Talk-1

Professor Rajni Singh, IIT (ISM) Dhanbad

- The Need for Incorporating Literature in Communication Skills Courses at B. Tech (freshmen): Some Thoughts

Chair: Professor PK Panda

3:45-4:00: TEA BREAK

4:00-5:30: Paper Session-3 (Poster Presentation)

Development of Speaking Skills through Digital Storytelling in Multilingual Classroom

- Samrat Bisai (IIT Patna)

Teaching and Learning in CBCS: Matter and Prospects

- Sana Arif Ansari (AMU)

There's a better way to do it: A socio-political commentary with an out of the box teaching-learning initiative

- Aritra Saha (Heritage Institute of Technology) & Somerita Banerjee (DPS), Kolkata

Using Story Grammar to Assist ESL Students of West Bengal Board Vernacular Medium Schools Improve their Comprehension

- Madhusree Mukherjee (Jadavpur University)

Teaching Health & Nutrition: Desired Teaching Learning & its Essentials

- Sharda Singh & Alok Gardia (Faculty of Education, BHU)

Teaching Korean language to Hindi speakers in BHU

- Sun Gil Park (Foreign Language, BHU)

Project Based Learning in Teaching English Language Vocabulary

- Ashwini Jagatap (Rajarambapu Institute of Technology, Rajaramnagar)

The Role of Classroom Interaction in Developing Second Language Reading

- Gautam Naskar (IIT Roorkee)

Changing Perspectives and needs in Internship of teacher education

- Kaushlendra Singh (AMPG College, BHU)

E-learning, M-learning and traditional education system in the age of information technology

- Divyendu Mishra (MGIHU Wardha)

Moderated by: Dr. Sanjukta Ghosh

March 9, 2019, Saturday

9:30-10:15: Paper Session-4

Experiential Learning in Semiconductor Devices and Physics B. Tech ECE Course: Capacitive Sensor

- Menka Yadav (NIT Trichy)

Student's perception on relevance of seminar-based pedagogy in the coursework of doctoral programme in management

- Manoj Kumar Yadav (IIM Indore)

Chair: Professor RK Mishra

10:15-10:45: TEA BREAK

10:45-11:30: Invited Talk-2

Professor Pradeep Rao, Principal, MPPGC- Gorakhpur

- Present Policy and System of Education: My Experience

Chair: Dr. V Ramanathan

11:30-1:00: Panel Discussion-1: PMMMNMTT and Reports

Filling Gaps in Science Teaching in Schools: Our Experiment and Experiences

- Richa Raghuvanshi, Gautam Geeta J, Sailaja Sunkari and Vinod Kannaujiya (MMV, BHU)

Observational study and findings of Month long Induction Training Program in TLC, TU under PMMMNMTT Scheme

- Swapnarani Bora & Bhushita Patowari (TLC, Tezpur University)

Feedback Study of Faculty Induction Program of TLC, IIT (BHU) Varanasi

- Sanjukta Ghosh (IIT BHU)

Visible Gap Identification in Vocationalisation of Higher Education

- Aruna Singh, Sachin Rai & Ashutosh Rai (TLC, NITTTR Bhopal)

Chair: Professor RP Shukla

1:00-2:00: LUNCH BREAK

2:00-3:00: Invited Talk-3

Professor Satya Sundar Sethy, IIT Madras

- Assessing students' achievements of a course: Roles and responsibilities of higher education teachers

Chair: Dr. Sanjukta Ghosh

3:00-3:30: Paper Session-5

Applying ENgagement and Application Based Learning and Education (ENABLE) – A Student Centric Learning Pedagogy for Effective Learning of Database Management System

- Shefali Trushit Naik & Kunjal Gajjar (Ahmedabad University)

Sharing teaching-learning on environmental studies

- Devendra Mohan (IIT BHU)

Chair: Dr. Sanjukta Ghosh

3:30-4:00: TEA BREAK

4:00-5:00: Panel Discussion-2: Education and Ethics

Panellists

Professor BK Tripathi, Director, IUCTE-BHU

Professor RP Shukla, Dean, Faculty of Education, BHU

Professor Alka Singh, Principal, VCW, Rajghat, Varanasi

Professor RK Mandal, Professor of Metallurgy, IIT (BHU)

Moderated by: Dr. V Ramanathan

5:30-6:00: Valedictory

Coordinate: Dr V Ramanathan

Chair: Prof RK Mandal

Report: Dr. Anil Thakur

Remarks by Prof. P Shukla, Chairman, TLC, IIT (BHU) Varanasi

Remarks by the Chief Guest Prof BK Tripathi, Director, IUCTE-BHU

The Vote of Thanks: Dr. Anil Thakur

Appendix – B

Paper reviewers

- 1. Dr. Anil Thakur
- 2. Dr. Sanjukta Ghosh
- 3. Dr. V Ramanathan