

Influence of Learners' Diversity on the Pedagogical Practices in Engineering Education: A Meta-Analysis of Teachers' Reflections

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Abstract—The escalating transits of learners across the international boundaries have resulted into several eruptive pedagogical practices in the class room teaching. A paradigm shift in the pedagogies has been experienced by the teachers to fulfilling the academic demands by the international learners. Though the teaching-learning processes have become more effective, versatile and technology driven due to the learners' diversity, it may be important to understand the challenges, barriers and psychological reflections by the teachers in facing these transformations. The article analyses the reflections by the teachers on the catering to the student's diversity. Total of sixty one teachers from different engineering streams participated in the survey. The data were collected anonymously. A meta-analysis has been carried out to obtain the similarities and differences of reflections on various hypotheses. All the important attributes of academics namely pedagogic, assessment, method of instructions, cultural integration of students in a common task, and overall influence of the diversity on the teaching-learning processes have been discussed. The study revealed that the teachers had to accommodate the diversity in their concurrent pedagogic and students had to develop new learning styles. The teachers have shown agreement on most of the hypothesis mentioned in the questionnaire; however it was found that catering the students' diversity in the class room is the function of the interpersonal skills, academic experience and ability to communicate effectively with the diversified learners. The results established that the teachers will have to accommodate the learner's diversity by a continuous up gradation and by embracing the new ways of pedagogical practices. The study inspired the authors to propose a model for effective pedagogy in the diversified class rooms and has been presented for the futuristic discussion by the readers and academicians.

Keywords—Diversity; Engineering education; Learners; Meta-analysis; Pedagogy; Teachers

JEET Category—Equity, Culture and Ethics in Engineering Education- (Diversity and Inclusion in Engineering Education).

I. INTRODUCTION

The premier universities of India, offering a wide range of professional courses and programs have witnessed a drastic shift in the learners' diversity like ever before in the past few years. Several educational schemes and programs launched by the honorable government of India have attracted students to come and study in various courses in the reputed and accredited universities and colleges imparting the professional courses (Gupta, Asha, 2005). As an approximation, over 60,000 students have enrolled in different engineering programs alone in the Indian universities in the year 2019-2020, and once again after the COVID-19 dip, the ratio of the international students in India has begun to rise. Marwadi University at Rajkot, Gujarat being one of the favorite choices by the international students as their learning destination is one such example. The university has been hosting students from more than 59 countries registered in different professional courses. The university has embraced and accommodated the students from different cultures, languages and nationalities at the campus successfully in the past few years.

While having a large numbers of the diversified students in the class rooms, the teachers have been dedicatedly working on the fulfillment of the academic requirements of the international students. Especially, when the class rooms are a rich blending of regional, national and international students, catering to the educational needs becomes a challenging task. In the context, the higher education institutes (HEI) in the country have started making necessary changes in the curriculum also to address the community based diversity of the students (Gilbert, D. J. at al, 2015) by introducing new courses. The better management practices are also under the development at HEI (Veluvali, P., & Suriseti, J. 2022). On the other hand, several modern methods and approaches for the pedagogical practices are introduced to the teachers in the HEI. The new pedagogical practices are largely influenced by the learners' diversity in a class. This is due to the reason that the class rooms have become more heterogeneous compared to the earlier times (Forlin C., 2012). The changing pedagogy may be subject oriented, country specific or dependent on the program types in some cases as observed and discussed by the researchers (Didiano, T. J. at all, 2022; Kamalov, F., 2022; Rao, P., 2017). However, the Indian universities have also undergone huge transformations in pedagogies for the diversified students in the class, several modern and

innovative methods such as model based learning, collaborative learning, project and problem based learning in past few years, it may be necessary to review the transitional twist in methodologies and the torque of changes experienced by the teachers. Moreover, the reflections by the teachers may support and reveal a few unknown facts about the influences of the presence of the international students in the class rooms on their pedagogical practices. Therefore, this article represents the results of the meta-analysis of understanding the changes occurred in the pedagogical practices of the teachers teaching the professional courses in a diversified class rooms. There are few potential areas where the pedagogy for the international learners may be revised or improved and that is possible when the ground realities and real feedbacks get observed carefully and scientifically (Ryan, M. et. al, 2022)The present study consists of the important observations; information and analysis of the feedbacks received from the faculty members.

II. METHODS

The study has been conducted by collecting the feedbacks of the teachers associated to Marwadi University. The feedbacks are obtained via an anonymous survey offered to sixty one engineering teachers from the different soft and core streams. The identities were not collected from any of the participant to keep the survey more factual and realistic. The questionnaire was prepared with ten questions. The meta-analysis processed on the collected information was of not-fixed format type. The questionnaire was consisting of the different nature of the questions; therefore the meta-analysis was necessary to carry out depending upon the responses. Fig.1 explains the overall process of analysis of the data.

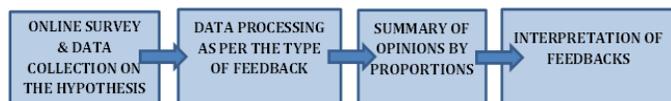


Fig.1 Overall process of the study conducted

It is necessary to discuss the formation of the questionnaire before the result discussion. The questionnaire was prepared as per the ten different hypotheses listed below in Table 1. Largely the survey was based on the opinions and asking to the participants to respond as per the real experiences.

As mentioned in the table, the maximum feedbacks were designed as per the experience of the teacher. The responses of the experience based feedbacks have been collected and presented in the form of the proportion based graphs and have been interpreted as per the percentage of similarity and disagreement. Apart from the feedbacks received, the authors have incorporated their own experiences in the interpretation of the feedback and responses.

TABLE 1
LIST OF HYPOTHESIS FOR QUESTIONNAIRE

Sr. no.	Hypothesis based question	Type
H1	"A diversified classroom imposes pedagogical challenges", what is your opinion?	Opinion
H2	Please select the most challenging attribute of your classroom teaching for the diversified learners.	Experience
H3	What significant changes you have made in your pedagogical practices for an effective teaching to address the diversity?	Experience
H4	Do you think that the diversity has changed the assessment and evaluation methods?	Opinion
H5	During your preparation for a lecture, do you start recalling the specific cognitive qualities of the international students and may have changed your plan accordingly?	Experience
H6	Do the diversified learners follow the common methods of instructions?	Opinion
H7	If you are unclear on a concept to foreign students, what reflections you have noticed during the class?	Experience
H8	Now because there are students from the foreign countries in a class, what changes have happened to the national or regional students' learning attitudes?	Experience
H9	If the groups of foreign and the native students are juxtaposed for in-class dominance what have you observed?	Experience
H10	Kindly select one pedagogical practice that in your experience has worked effectively for addressing the diversity of students in class in nearly all respects of T & L attributes and to that the students have responded as maximum.	Experience

III. META-ANALYSIS

The explanatory meta-analysis was performed on each hypothesis statement according to the response received. Each of the responses has been discussed in detail in the article later. The overall frame work of the meta-analysis followed in the present study has been illustrated in the given below Fig. 2. The dependencies, inter-dependencies and independencies of the objectives or the questions have been illustrated in Fig.3.

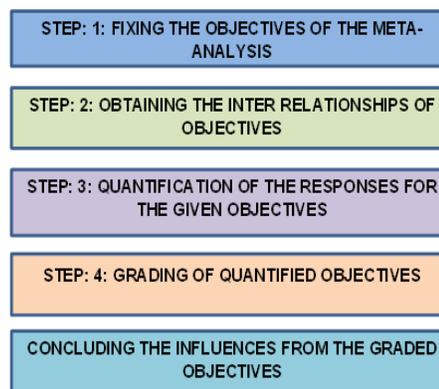
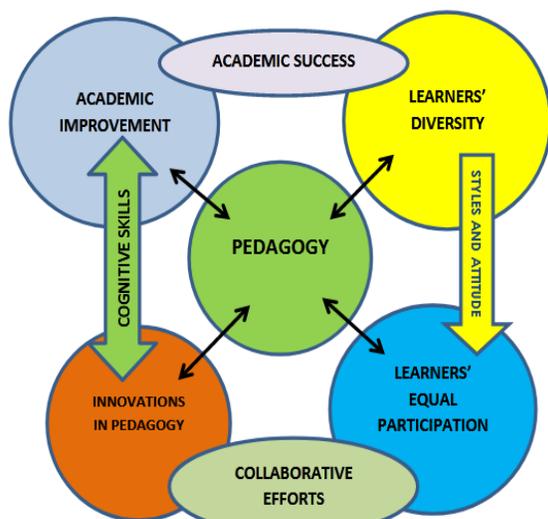


Fig. 2 Methodology for meta-analysis

From the illustration, the process of meta-analysis may be clearly understood. The steps are designed as per the intended outcomes from the study as the overall findings. The importance of fixing an objective and the qualitative analysis

are the two major steps to be followed for such analysis where the qualitative work is to be done. The special feature of the meta-analysis is its flexibility to include all the independent variables in the consideration to reaching at the common finding. There were five objectives for the meta-analysis finalized from the hypotheses namely (a) Pedagogy should cater diversity (b) Diversity should bring academic improvement in class (c) Diversity should inspire new pedagogical methods (d) Assessment and evaluation should be revised as per the diversity of learners and (e) The changed pedagogy should include all learners with maximum participation. Fig. 3 illustrates the internal relationship of the objectives.



© Bhogayata-Jadeja: Pedagogical objectives and relationship for diversified learners

Fig.3 Relationship of the objectives of meta-analysis

The objectives of the meta-analysis are closely related with each other and show clear influences on the pedagogical processes. Similarly, the pedagogical process is connected directly with the objectives by means of the functions mentioned in-between. It begins with the learners' diversity and without the equal participation the attainment is difficult, however the diversity is a function of the learning styles and attitude as obtained from the survey. The equal participation encourages the evolution of the innovation of the pedagogies and may be obtained by the function of the collaborative efforts of teacher and students. Finally the innovative pedagogical practices can result into the academic improvement being the ultimate objective of the teaching-learning processes and further it can be seen as the function of the cognitive learning capacities of the learners and the cycle moves on as the function of the academic success. Interestingly all the objectives revolve around the pedagogical practices and that is why the reflections of the changing pedagogies and requirements by the diversified learners are important to get correlated closely and with the wider scope.

IV. RESULTS AND DISCUSSION

The results in form of the data collected from the survey have been collected and interpreted qualitatively. Each hypothesis has been discussed based on the corresponding reviews collected.

A. Reflections for H1

The hypothesis was about whether the faculty is on the opinion that the diversity imposes change of the pedagogy or not. Given below is the reflection;

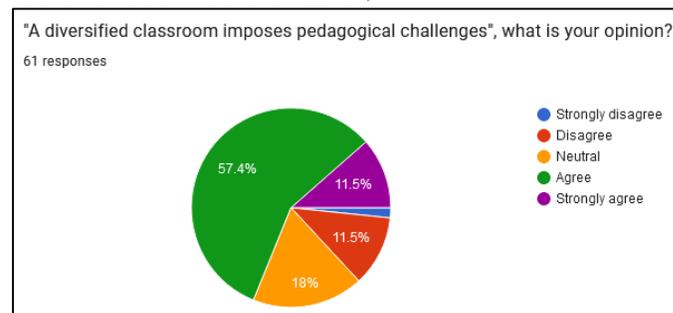


Fig.4 Reflections on pedagogical challenges

As evident, more than 70% faculty members agreed. However, there are few reservations also and have remained with neutral opinion. Moreover, nearly 12% have disagreed to this question. The reason being may be the experience of addressing the diversities in the class rooms by the faculty members. It may be noticed that the agreement shows capability of the faculty to take challenges of pedagogy. Also, it may be taken as a positive sign for the adaption of the new pedagogy is not regarded as the limitation and the international students will like the same.

B. Reflections for H2

The reflections under this hypothesis showed excellent clarity on the two main components being the challenges to the teachers. As shown in the Fig. 5, the responses are suggesting that the communication gap and learners' attitude are major obstructions in the effective teaching. This was well expected as the language of instruction plays a vital role in teaching. Also the diversified learners are bound to have varying learning attitudes due to many reasons including their settlement in to the new environment also. It is to be noted that nearly 39% teachers have mentioned that the foreign students were struggling with the fundamentals and that may have resulted in the learning difficulties. This is important to know because this is how the slow learners may get identified and given special coaching for the improvement.

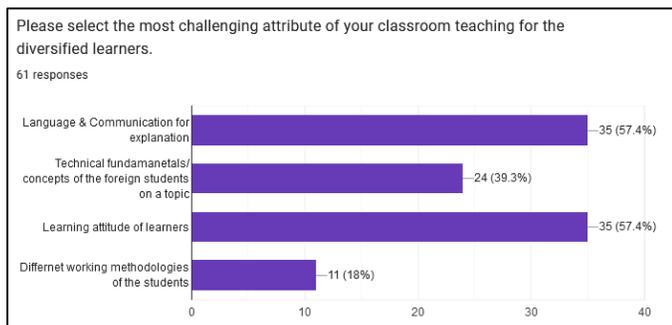


Fig.5 Most challenging academic attribute

C. Reflections for H3

The reflection was related to the changes made by the teachers to accommodate the diversity in the class. The hypothesis supported the exploration of the intensity of the specific methods of teaching and well accepted by the most of the learners in the class.

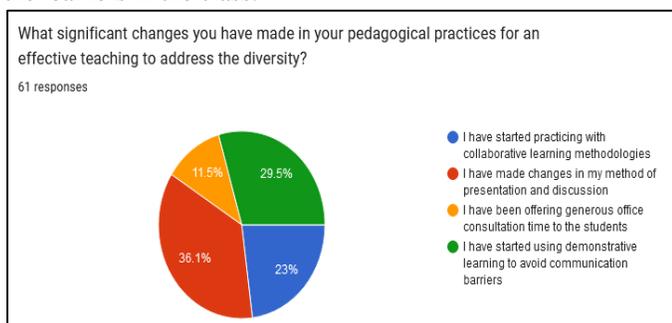


Fig.6 Changes due to class room diversity

About 36% of the teachers had to change their method of presentation and discussion. This means, the pedagogy is governed by these to attributes primarily. It is very important to closely observe such responses as later it may be taken as the area of focus and can be shared with the other teachers for refining.

D. Reflections for H4

One of the most important and the student centric attributes of the diversified class is the evaluation or the assessment of the academic performance of the students. Therefore, this component has been included in the survey to understand the influence of the diversity on the academic assessment. The teachers were asked to share their experience on did the diversity affected the assessment and if yes to what extent. From the Fig.7 the result suggested that nearly 41% of the teachers agreed. However on the other hand, the disagreement was also found to be around 36%. In addition, the teachers were found to be uncertain about the influence also. This may be due to the combined response by the learners and may be observed as the multi-dimensional attribute. This an important outcome of the survey that the teachers require more training on how to cater the diversity of learners with respect to the assessment and academic performance assessments. The area may be taken up as an individual research topic also.

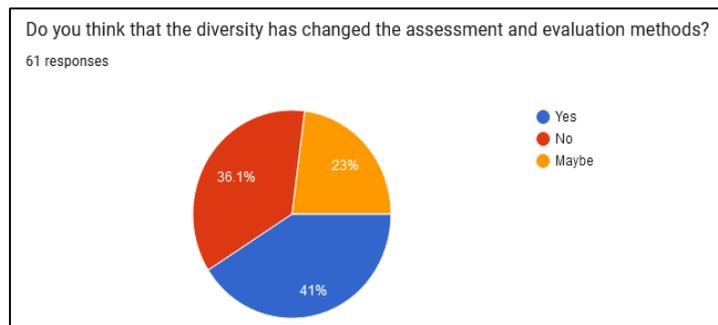


Fig.7 Effect of diversity on assessment

E. Reflections for H5

The teachers are habitual to prepare notes, literatures and scribbles for personal and students' clarification may times and such aids are helpful in overall pedagogical processes. Therefore, how the diversity may influence the lecture preparation was found important to be analyzed. This hypothesis was based on the assumption that if the diversity exist in the class room, a teacher need to reform the teaching methodology and way of discussion. The results are very much clear as shown in Fig. 8. More than 70% of the teachers agreed to the statement that the diversity has a deep influence on the lecture preparation by a teacher. While considering the cognitive capacities of the learners, the teacher will definitely revise or change the way of teaching to cater the demand of learning abilities. It may be noted that diversity need not to taken as a higher academic levels of students. Not all the learners are of higher levels in a class. On the other hand when the learning environment changes, the students may feel lagging in their conventional cognitive capacity. Therefore, the response is correctly reflecting the notion of a teacher involved in the teaching to the diversified class room.

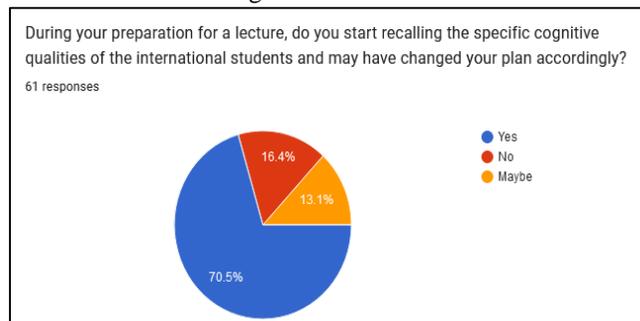


Fig.8 Cognitive learning and diversity relationship

F. Reflections for H6

An effective communication in terms of the set of common instruction is a very important pedagogical attribute for any class room teaching (Meganathan, R. 2022). For the highest level of attainment in the academic performance of the learners, the correct flow of the instructions and clear communication is like a pre-requisite. This parameter becomes more vital when it is regarding the diversified learners. Many a times, foreign students struggle with the communication in the class room by the teachers and instructors and may not get the clear idea about the work to be done. Therefore, the teachers were asked to provide their experience on this point.

As it can be observed from Fig. that more than 60% of the teachers agreed that the foreign students were following the common set of instructions. However, nearly 26% teachers responded that there is a need for the special instruction and separate communications were required for the diversified class room.

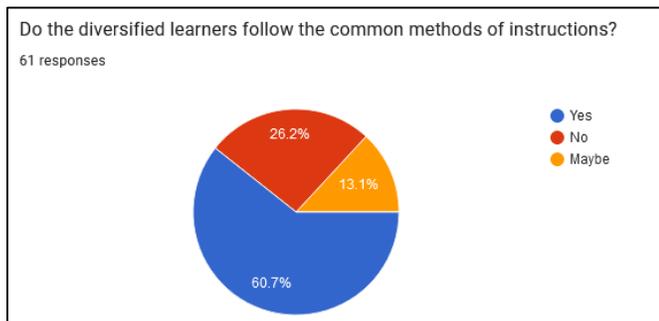


Fig.9 Diversity and instruction relationship

G. Reflections for H7

Attentive students are very important for the class and successful outcome of the pedagogic process. It is assumed that if the students are self-motivated and are not getting any of the concepts clearly from the pedagogic processes, they come forward with doubts and try to clear the same with the teachers. The same may be applicable to the foreign students. Being a diversified class, it is important to focus on this aspect also. The teachers have responded to this scenario with 59% agreement that the students do not hesitate to stop the session and ask the doubts. However, a few have observed that students become inactive also. There is another practice by the foreign student, that they take help of their fellow for doubt solving during the sessions. 16% of the teachers have observed this type of response from the students in case they are not clear in the content being taught. This is to be minimized by the teachers and there should be an environment where student prefer to raise doubts to the teachers first. Learning and understanding is a function of the cognitive capacity of the learners, however the teacher may increase the level of understanding with appropriate inputs and additional efforts.

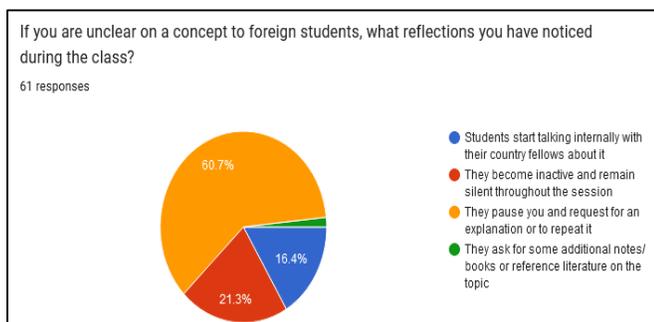


Fig.10 Relationship of doubt solving and diversity of learners

H. Reflections for H8

In this hypothesis, the influence of the presence of the international students on the native students has been cross verified. The hypothesis was that the presence of the foreign students definitely creates an impact on the native students.

But to what extent was not exactly known. Fig. 11 demonstrated this scenario. According to the response it has been observed by 67% of the teachers that the native students have not altered their learning attitude owing to the presence of the foreign students. On the other hand as observed by 32% of the teachers, the students started changing their learning styles and attributed became positive and more attentive. This is probably due to the indirect competition within the class room academic environments. Such changes in the learning attitude are always effective and useful for raising the level of the overall academic objectives.

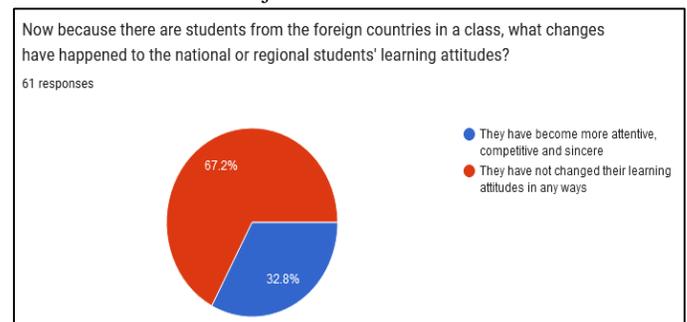


Fig.11 Influence of the foreign students on the native learners

I. Reflections for H9

Along with a healthy competition, it is necessary to observe that are there any signs of the overriding of the communities over each other in a class or not? This is important to observe because the overall academic progress of a class is a function of the homogeneity of the learners in terms of cooperation for the common task. The hypothesis was presented to the teachers on this scenario. It was observed by nearly 57% of the teachers that even being a diversified class room, the communities namely national and international have remained detached to an extent as far as the coherence of the attitude is concerned. There are classes where the positive coherence has been observed nearly 32%. There is an interesting fact revealed that in 8% of the teacher's review the native students have made the foreign students to adapt their learning styles. This is important scenario and shows the positive response by the communities from the either sides.

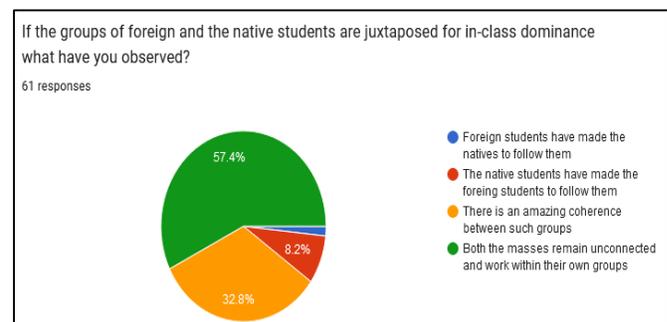


Fig.12 Dominance of the learners' mass in the diversified class rooms

J. Reflections for H10

Being the most critical and important of the given set of hypotheses, this specific question showed the most interesting and nearly balanced reflections on the type of pedagogical practice which was able to address the diversity of the

learners. 26% of the reviews suggested that the utilization of the teaching aids proved to be effective for teaching. Similarly 25% teachers found that group learning was the better option to cater the diversity. Moreover, the project based learning was successful as reflected by 23%. A good number of teachers showed that the instruction based or the conventional method of teaching worked well and with a small amount of success ratio of 8% and 6% the model based learning and flipped class room worked well as a main pedagogical practice. The reflections to this hypothesis showed that an effective pedagogy for the diversity of the learners is a function of the innovative practices. This is why because, when the modern methods of learning are adapted, the barriers of the communication, personalized teaching habits, style of learning of a student, lack of study materials and complexity of the concept tends to get reduced significantly. The learner becomes more comfortable with the use of models, projects, visuals, animations to get the central idea of the content and does not require more verbal communication or explanation. It may be clearly concluded that while catering the learners' diversity in the class room, the effective use of modern pedagogy is a key factor and a way to attain the desired outcome in terms of knowledge sharing, assessment and attainment level.

The importance and significance of the appropriate pedagogy to cater the diversity of the class room was confirmed and became more relevant in case of having the combination of native and foreign students together in a class participating into the learning process via the modern methods of pedagogical practices.

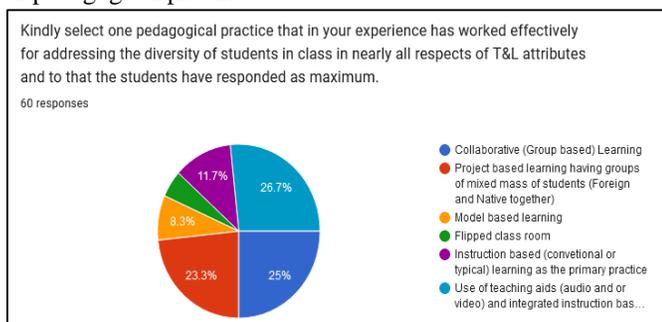


Fig.13 Most effective pedagogy for diversified class room

K. Summary of the analysis and results

All the ten hypothesis and their reflections by the teachers have been analyzed qualitatively with the results obtained in the feedbacks. Largely the feedbacks were in the form of the percentage of agreements and disagreement. Moreover, the opinions were also found to be significant with the given options as the possible answers to the questions in the survey form. By critically analyzing the reflections, a summary of the results may be prepared as shown below. The conclusions based on the summary have been discussed in the advancing section.

- The diversity influences the pedagogy and imposes changes in the conventional styles
- Language for communication and learning attitude of the students are the significant parameters to cater the

diversified class room.

- Most affected pedagogical practice is the style of presentation of the contents in the diversified class rooms.
- Learners' diversity imposes changes and innovations in the assessment and evaluation patterns.
- The cognitive capacity of the learners in a diversified class room influences the content preparation.
- With adequate clarity, the learners in a diversified class room are able to follow the common instructions by the teachers.
- The diversified learners ask the doubts without any reservations that may be due to the innovative or changed pedagogical practices.
- There are no significant or major adverse impacts of the presence of the foreign students on the learning attitudes of the native learners. This is a positive indication of the diversified class room.
- Use of teaching aids, collaborative learning, and project based learning are the three most significant and successful pedagogical practices acclaimed by the teachers to cater the diversified class rooms irrespective of the course and program types.

V. LEARNING LESSONS FROM THE STUDY

The present work dealt with the reflections of the teachers on the catering the requirements by the diversified class room learners. The anonymous survey regarding the opinions for the hypothesis revealed that the the communication or the language of instruction is one of the important parameters for the diversified class room. Similarly the learners' diversity is a function of the effective pedagogy and requires use of the modern methods namely, collaborative learning, ICT enabled presentations of the contents and project based learning for the effective communication and desired attainment level of the course or program. There are no negative impacts observed owing to the blending of the learners from the different nationalities. In the contrast it was observed by the teachers that the presence of the foreign students promoted the healthy competition amongst the students and that may result in the better outcome and success of the academic performance of the class room. To cater the diversity of the class room learners it is necessary to understand learning styles, language proficiency, learning attitudes, method of working and levels of cognitive learning capacities of the learners (Herzog-Punzenberger, B.etall.,2022). It is to mention that the models and methods suggested in the work are based on the feedbacks and reflections of the teachers belonging to one specific organization. The authors are working towards making the methods and models more generalized for its utilization for groups of institutions.

VI. MODEL FOR PEDAGOGICAL PRACTICES FOR A DIVERSIFIED CLASS ROOM TEACHING

Based on the survey and reflections, of this study a model suggesting the effective pedagogical practices has been

proposed. The model is referred with an abbreviated form “**UDAAN**”, where U: Understand, D: Deliver, A: Assign, A: Assess, and N: Neutralize. The model is illustrated below in Fig. 14 and discussed in detail in the advancing paragraph. It is the innovative contribution by the authors and the design of the model has been secured with the authors.

The teachers involved in the engineering education and trying to cater the diversity of the learners in the class rooms have shared several important and innovative details. The teachers have expressed their achievements, challenges, limitations and opinions for effective teaching-learning process in the diversified class rooms of engineering institute. Based on the outcomes and qualitative meta-analysis of each result, a model in the form of the five attributes has been prepared. The engineering teachers may utilize the same to refine their pedagogical practices for catering the diversity of the learners.

The first step is to **Understand** the specific requirements of the learners. It is likely to have students of different learning styles and may seem difficult to teach all with a conventional approach. A teacher has to have an excellent command on English being the most utilized language of instructions and communication. Though the pronunciation may become a challenge but that the most effective way to convey the information and share the knowledge. Along with the language, a teacher should observe the working styles of the learners. Unfortunately this is the major point commonly ignored by the teachers and the attainment suffers due to such small things. A learner will perform the task in its own conventional style that should be known to the instructor. Forcing the learners to follow a different way of working may result into a catastrophic failure of the optimum performance of learners.

The second attribute is the **Delivery**. The content should be simple and interactive for the learners to understand the gist of the overall knowledge. Use of more visuals and illustrations will reduce the hurdles of the communication gaps. Programming the lectures or sessions as per the cognitive capacities of the learners will be the best possible solution. However, a careful observation of working styles is highly recommended.

The third attribute is how to **Assign** work to the diversified learners. It is very important that the class should work in a common direction but at the same time, the activity should be suitable to each individual learner. This is observed by the authors and colleagues at the Marwadi University also.

The reflections have suggested that few learners are comfortable to work in a group; some will prefer the project based learning and few will find the Flipped class rooms as an interesting exercise. The time has come to offer the type of assignment to the students of their own choice. The central objective should not change but the learners should be happy to work with their own style to solve the assignments and exercises. At Marwadi University, the students are given a choice to select the type of the assignment of their choice out of a bucket of the assignments. It is true that it seems difficult in first look, however, once the system gets established it really work wonderfully as per the real experiences of the teachers of the university.

The fourth attribute is most significant and necessary to be considered, that is **Assessment** of the learners. Assessment must be innovative and with varying styles and modes so that the learners can be assessed appropriately. The conventional methods like written exams and descriptive exams may not be suitable to all. Therefore, there can be a continuous evaluation system and that to with the flexibility of preparing presentations, small videos, digital assignments, model making, case studies, oral examinations and any similar innovative way may be employed.

It is well known to us, as a teacher that not all students are comfortable to a single method of assessment and specially for the foreign students, one has to understand that from what background of the evaluation they have come to us. In fact, at the Marwadi University, the teachers in charge or the subject coordinator with the due consultation of the class coordinator decides what type of the evaluation approach will be offered to the students. Some subjects are offered with the open book exams where students need not to mug up the things but perform on their own intellectual capacities and abilities. Our students are offered with the one-liners, MCQ, model making and Presentation and video based assignments and are evaluated based on the performance as an individual and as a group member also. This is working very well and the students are also highly satisfied with the practice. In fact, the authors have started working on the project where the anonymous survey of the students is in the progress to have reflections on exclusively on the assessment system being offered to them. The authors are looking forward to producing another interesting article out of the information in near future.

The fifth attribute is to **Neutralize**. This may be a relatively new to most of the teachers. As per the authors’ observations, the assessment and assignment performances are varying with the diversity of the learners. Though for a teacher, all students are same, however many a times the learners have a few grievances and clarifications especially in the assessment and evaluation system. A teacher may be able to reduce or mitigate such grievances by offering the make-up assignments and tests as mentioned in the Fig.14. We as a teacher should accept that the learners are always trying to prove them self with the best of their capacities, however due to some methodologies of assignment and assessments, they feel uncomfortable to perform with their optimum strength. Therefore, we at Marwadi University have adopted the varying styles of supplementary learning for the diversified learners. This practice includes more than the method of extra coaching. For this, the teacher has to understand that why the student is not performing well and what is the exact issue. There are chances that the learner may not have get the fundamentals due to the language or pedagogic methods. Therefore, by offering the innovative neutralizing methods, the teachers may encourage them for better understanding. Once the special training is done, the student may get re-evaluated or re-assessed. This is a time demanding process; however it is necessary to win the learners’ confidence in the system offered by the institute. Therefore, the notion of neutralize is very significant and must be included in the pedagogical routine. The authors would like to mention that the model is prepared with the generic

perspective and the same may get modified by the organizations as per the availability of the foreign students in the class or at the campus. The primary objective of preparing the model is to cater the varying requirements of the diversified learners with all possible ways and to make them believe in the systems offered by the organization. The survey conducted on the influence of the diversity of the learners and pedagogical practices provided several known and unknown information. Based on the information, the model has been proposed. Out of many significant parameters, the top five have been selected and described in detail in the design itself. It has been designed as a device or a tool for enhancing the pedagogical practices required for the diversified learners. The teachers at the Marwadi University are continuously mentored by the leaders of the pedagogical practices via faculty development programs and workshops on the innovative teaching methods and quality improvement programs. The authors would like to mention that with the necessary efforts of the teachers, utilization of the modern technological tools like MOOCs(Shah, V.et all. 2022), Virtual and Augmented Reality based labs, Canvas platform, and ICT enabled class rooms have supported all the essential changes required to redesign and redevelop the pedagogical practices by the teachers. Even the highly automated and transparent centralized evaluation system including the proctor exams and open book exams, the students have faced any challenges in the assessment as a rare event.

U UNDERSTAND	D DELIVER	A ASSIGN	A ASSESS	N NEUTRALIZE
A Teacher will have to understand following from the learners' diversity in the class	A Teacher may start delivering the contents based on the selected pedagogical strategies	A Teacher should carefully assign the work to the learners	A Teacher will be evaluating each learner with a rubric based evaluation	The learners' grievances may be settled by offering the makeup assessment styles
LEARNING STYLES	PROJECT BASED LEARNING	PROJECT BASED EXERCISES & CASE STUDIES	CONTINUOUS & PERFORMANCE BASED EVALUATION	RUBRIC DESIGN
COMMUNICATION EFFICIENCY	COLLABORATIVE WORK	MODEL MAKING & ACTIVITY BASED LEARNING	ATTENDANCE & PARTICIPATION	COACHING FOR SLOW LEARNERS
LEARNING ATTITUDES,	PRESENTATIONS AND DIGITAL AIDS	FIELD EXERCISES & DATA COLLECTION	TIMELY SUBMISSION	MOOCs FOR REFINEMENTS
METHOD OF WORKING	E-CONTENTS AND EXTRA NOTES	CHOICE BASED EXERCISES	PRESENTATION	SUPPLEMENTARY ASSIGNMENTS
On getting clear on the above attributes, the pedagogical method may be selected for the class.	The delivery aspect will drive the teaching-learning process and it will be more students centric.	Offering variety of the assignments will reveal the actual potential of individual learners instead of a monotonous work for all.	OPEN BOOK EXAMS	RELATIVE GRADING
		With a learning style, the performance is also depends on an individual learner, the same should be offered to all as equal chance to perform.		With an option for improvement by above methods a diversified learner mass will perform well and attainment will be achieved effectively.

© Bhogayata-Jadeja: UDAAN model for effective pedagogy for the diversified learners

Fig.14 UDAAN model for effective pedagogy in diversified class rooms

VII. CONCLUSIONS

The reflections received from the teachers on pedagogical challenges and changes required to cater the diversified class room or the learners' diversity provided several important and noticeable facts and aspects for the improvisation in the current and futuristic practices in the engineering education. Following are the noticeable conclusions derived by the authors;

- The learners' diversity is a function of the cognitive learning attitudes and learning styles. A careful study by the teachers of the diversified learners is a key factor to

success and attainment irrespective of the course and program.

- Inter-personal skills of the teachers namely communication, command on language, ability to assign the work and capacity to make the learners work collaboratively are the essential components of the pedagogical practices.
- The utilization of the modern methods of teaching can support relatively better understanding of the concepts for the diversified class room. Especially flexibility to select the type of work and assignments offered to the individual works significantly well.
- The diversified learners should be given a choice for the type of assessment with prescribed evaluation rubrics to achieve good grades and better score instead of being measure with the common rule of assessment. This is very important outcome and must get incorporated in the organizations having the diversified learners in the class rooms.
- The slow learners are inevitable and they must be given a fair chance in case of any failure to perform again and for this modern methods of examinations such as open book tests, project based work or group work type assignments can be devised.
- For a successful pedagogical practice in a class room with the learners' diversity, the teacher should be given full freedom and flexibility to plan the sessions, select the mode of delivery, design the type of assignment and offer non-uniform evaluation system within the gross objectives of the organization directing towards the highest level of attainment.
- The innovative design model termed as "UDAAN" proposed by the authors may be studied with more details and get customized with necessary modifications by the teachers and universities imparting the engineering education and more generically the professional courses to the diversified learners at their campus.

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REFERENCES

- Gupta, A. (2005). *International Trends in Higher Education and the Indian Scenario*.
- Gilbert, D. J., Held, M. L., Ellzey, J. L., Bailey, W. T., & Young, L. B. (2015). *Teaching 'community engagement' in engineering education for international development: Integration of an interdisciplinary social work curriculum*. *European Journal of Engineering Education*, 40(3), 256-266.
- Veluvali, P., & Suriseti, J. (2022). *Learning Management System for Greater Learner Engagement in Higher Education—A Review*. *Higher Education for the Future*, 9(1), 107-121
- Forlin, C. (2012). *Diversity and its challenges for teachers*. In *Future directions for inclusive teacher education* (pp. 105-114). Routledge.
- Didiano, T. J., Simpson, A. E., & Bayless, D. (2022). *Pedagogical approaches for facilitating engineering leadership development*. *New Directions for Student Leadership*, 2022(173), 43-51.
- Kamalov, F., & Leung, H. H. (2022, February). *Numerical computing in engineering mathematics*. In *2022 Advances in Science and Engineering Technology International Conferences (ASET)* (pp. 1-5). IEEE.
- Rao, P. (2017). *Learning challenges and preferred pedagogies of international students: A perspective from the USA*. *International Journal of Educational Management*.
- Ryan, M., Rowan, L., Lunn Brownlee, J., Bourke, T., L'Estrange, L., Walker, S., & Churchward, P. (2022). *Teacher education and teaching for diversity: A call to action*. *Teaching Education*, 33(2), 194-213.
- Meganathan, R. (2022). *Language Conundrum: English Language and Exclusivity in India's Higher Education*. In *Critical Sites of Inclusion in India's Higher Education* (pp. 81-96). Palgrave Macmillan, Singapore.
- Shah, V., Murthy, S., Warriem, J., Sahasrabudhe, S., Banerjee, G., & Iyer, S. (2022). *Learner-centric MOOC model: a pedagogical design model towards active learner participation and higher completion rates*. *Educational technology research and development*, 70(1), 263-288.
- Herzog-Punzenberger, B., Brown, M., Altrichter, H., & Gardezi, S. (2022). *Preparing teachers for diversity: how are teacher education systems responding to cultural diversity—the case of Austria and Ireland*. *Teachers and Teaching*, 1-18.