Effective Deployment of Outcome Based Education: Strategies based on Motivational Models

Shreeranga Bhat[1*], Rio D'Souza[2], Sathyendra Bhat[3], Ragesh Raju[4], Pavana Kumara B[5]

[1]Department of Mechanical Engineering, St Joseph Engineering College, Mangaluru, Karnataka, India
[2]Department of Computer Science and Engineering, St Joseph Engineering College, Mangaluru, Karnataka, India
[3]Department of Computer Applications, St Joseph Engineering College, Mangaluru, Karnataka, India
[4]Department of Computer Applications, St Joseph Engineering College, Mangaluru, Karnataka, India
[5]Department of Mechanical Engineering, St Joseph Engineering College, Mangaluru, Karnataka, India
[1*]shreerangab@sjec.ac.in
[2]riod@sjec.ac.in
[3]sathyendrab@sjec.ac.in
[4]rageshr@sjec.ac.in
[5]pavanak@sjec.ac.in

Abstract: The very purpose of the article was to discover the effective deployment strategy for Outcome Based Education (OBE). The article addresses one of the affective domains (motivation) of Blooms Taxonomy in implementing the OBE. The Maslow's motivational model and ARCS motivational model was used to complement each other in the deployment of the outcome-based system. Two sections of a course were considered in the research design having same subject of study, syllabus and assessment methodology to compare and culminate the findings of old and new approach. Root-cause analysis was used to initiate the research whereas statistical analysis was performed to culminate the findings. The new deployment strategy based on motivational theories proved to be superior in the outcome of the course. The current research was unique and adds value to body of knowledge by paving the way forward for new opportunity for engineering education research among the academicians, researchers, and policy makers.

Keywords: Outcome Based Education, Maslow's Motivational Model, ARCS Motivational Model

1. Introduction

Outcome Based Education (OBE) approach has become one of the prime criteria for the quality enhancement, sustainment and accreditation across the globe, more specifically in India as per the statutory bodies [1-2]. The OBE is the guiding beacon to achieve the Graduate Attributes (GAs) or Program Outcomes (POs) defined by different accreditation agencies [3]. Having said that, need of the hour is to customize the OBE to socio-cultural challenges and higher education framework in India to ensure balanced approach towards teaching, administration and research work [4]. Challenges and issues in the deployment of OBE is astronomical due to the lack of understanding of the approach and lack of cross-functional collaboration in implementing the OBE [5]. Moreover, most of the research indicates the lack of belief and motivation in implementing the OBE is one of the stumbling blocks to generate fruitful results [6].

The scientific literature delineates that the adoption of appropriate motivational concepts/models would help in deploying any new approach in the systems [6-7]. Out of the spectrum of motivational theories, the literature highlights the fact that application of Maslow's motivational model and ARCS motivational model are effective in deploying and sustaining the quality in the system [8-9].

These facts and figures inspired to investigate application of motivational concepts in OBE. Thus, the objective of this research is to delve deeper to comprehend the adaptability of Maslow's motivational model and ARCS motivational model in OBE deployment. This motivated researchers to establish the following Research Questions (RQs):

RQ1: What is the applicability of Maslow's motivational model and ARCS motivational model in OBE deployment?

RQ2: What are the strategies for the effective implementation of Maslow's motivational model and ARCS motivational model in engineering education?

RQ3: What are the outcomes of new approach for OBE implementation?

The findings of this research would assist the academicians, policy makers and researchers to frame new strategies and adopt new insights in OBE deployment. Further, the research would pave the way forward to adopt the corporate culture/practice in higher education to deploy and sustain OBE system for ensuring quality in education.

2. Literature Review

A. OBE

According to Ron Brandt "Outcome-based education (OBE) is about preparing students for life, not simply getting them ready for college or employment". It is based on four concepts, 1) clarity of focus (curriculum design, instructional delivery, assessment is in line with the expected outcome), 2) expanded opportunity (ways and number of

times students get a chance to learn and demonstrate), 3) high expectations (all students able to do significant things) and 4) design down (design curriculum from the perspective of expected outcome) [10]. OBE taps the potential of students that is inherent in institution, staff and students. OBE deployment depends heavily on the performance and ability of the instructor to clearly define what constitutes the components of a quality performance. The major criticism about OBE is due to lack of understanding regarding the basic tenets and lack of clarity in deployment strategy [11]. Moreover, OBE is based on effective utilization of Bloom's Taxonomy Cognitive Domain, Psychomotor Domain and Affective Domain. Further, in affective domain 'Responding to Phenomena' is primarily based on the motivation of the students towards the course [6]. This indicated that need of the hour is to adopt the motivational models for the effective deployment of the OBE.

B. Maslow's Motivational Model

One of the prominent and proven motivational model in the corporate world is the theory of Hierarchy of Needs proposed by the Abraham Harold Maslow which outlines the five needs across the different levels of the organization. According to Maslow's theory, satisfaction and desire for needs go in sequential order of hierarchy as shown in Fig. 1 [12]. In addition, intrinsic motivators are paramount to initiate higher order thinking skills, core attribute of OBE, which can be addressed through Maslow's motivational model [13-14]. Moreover, it is ascertained that only motivated students can effectively apply their intellectual in educational experience. Also, literature indicates that very little work has been carried out on effectiveness Affective Domain in OBE implementation increasing which ensures interest in engineering among the students and preparing the students to face rapidly evolving global challenges [8, 14, 15]. This provoked to venture into the new framework for the deployment of OBE.

Fig. 1 Maslow's Motivational Model

C. ARCS Motivational Model

In 1984, after rigorous and extensive literature review on motivational theories, Keller has introduced the ARCS (Attention-Relevance-Confidence-Satisfaction) motivational model [16] as shown in Table 1. This model would gel properly with OBE, as core philosophy of both are same i.e. student-centric teaching-learning [17]. Moreover, the model would assist the students to derive satisfaction and a sense of accomplishment as it helps to provoke and sustain attention. Also, in this model course material is connected to outcomes [18]. The academic literature indicates the limited application of this model in OBE [9, 17-20]. This motivated to investigate its relevance in engineering education.

Table 1. ARCS Motivational Model

Categories	Definition	Process Questions
Attention	Netting the interest of students and nudging the curiosity to study	How can I make this learning experience stimulating and interesting?
Relevance	Addressing the personal needs/ objectives of the learner to nurture positive attitude	In what ways will this learning experience be valuable for my pupils?
Confidence	Assisting the pupils to believe/ feel that they will succeed and sustain their success	How can I via instruction assist the pupils to succeed and allow them to sustain their success?
Satisfaction	Reinforcing accomplishment with rewards (internal and external)	What can I do to help the pupils feel good about their experience and desire to continue study?

3. Research Methodology

The present research has adopted Action Research (AR) methodology, a variation of the case study methodology, wherein the researcher is not an independent observer, but a participant in the process [21-22]. Unlike other research methodologies, AR is concerned with creating organizational change, and simultaneously, studying the process involved [23]. This also ensures the active participation of the members from the organization under study. It is a robust methodology for the exploratory nature of the study. The strength of AR lies in treating research and action as inextricably interwoven aspects. Further, it brings together theory and practical solutions to develop practical knowing in pursuit of knowledge [24]. Moreover, AR is the most preferred methodology for engineering education research [25].

The teacher, being the researcher, has involved in the development of case study, and the research was performed on the same group of students within a particular semester for a specific subject namely 'Management and Economics' to ascertain the answers to the RQs. Two different models have been used to address the holistic motivation (Maslow's Motivational Model) about the course, and specific motivation (ARCS Motivational Model) about a module in the same course. These two motivational models have been utilized to make sure a comprehensive and meticulous understanding of OBE deployment from the overall perspective and specific perspective and to observe synergy between them. Further, root-cause analysis, and statistical analysis have been used along with the embedded attainment methodology adopted by the institution to culminate the research findings.

4. Case Study

The research has been carried out in an accredited organization which has implemented OBE with a specific framework accepted by the stakeholders. The institution has established an eco-system to foster the research in engineering education to initiate the innovation in teaching and learning. As per the vision of the system, it was decided to try a new methodology which would complement the existing approach of OBE deployment. This led to the adoption of best practices followed by the industries in implementing and sustaining quality initiative in the organization.

Firstly, it was decided to carry out root-cause analysis as per the industrial standards and same is shown in the Table 2. The why-why analysis was adopted to penetrate into the root of the problem. The analysis revealed that lack of motivation within the educator and students are the prime reasons for the stumbling block in deploying the OBE effectively. Thus, it was decided to use Maslow's Motivational Model and ARCS motivational model to address a specific course and a specific module respectively.

Secondly, Maslow's motivational models has been used to establish a comprehensive strategy which would ensure intrinsic motivation among the students. The Table 3 shows strategies adopted for the course 'Management and Engineering Economics' to ensure highest level of motivation through meticulous utilization of essence of the model and to satisfying different level in the in the model.

Later, a strategy also been framed to address the one specific module of the same course through ARCS motivational model. The ARCS model has been subdivided to more clarity and focus and linked to the expected outcome of the module 'Planning' of the same course. Further, pedagogy of engagement was chalked out for the effect deployment of OBE as shown in Table 4.

Table 2. Root-Cause Analysis for effective Deployement of OBE

Root-Cause Analysis		
Project Name: Lack of Deployment strategies for OBE	**Project Manager:** Dr Shreeranga Bhat	
Problem Title: Why system/staff lack effective deployment of OBE		
	Answer what caused the specific situation?	**Answer why the problem wasn't detected?**
1st Why? (Lack of Students' Motivation)	Because students are not interested in the subject.	Because no formal metric of measurement/ follow-up to ascertain the same.
2nd Why? (Not Interested)	Because they are unaware about the 'wow' factor of the subject.	Because lack of structured approach towards teaching-learning.
3rd Why? (No WOW factor)	Because educator not facilitated the discussion towards it.	Because lack of awareness of pedagogy of engagement.
4th Why? (Lack of facilitation to towards teaching-learning)	Because of lack of planning about the subject.	Because lack of ownership in the process.
5th Why? (Lack of planning)	Because of lack of motivation within the Educator.	Because lack of system to ensure learn, unlearn and relearn
Root Cause	Lack of Motivation within the educator	Lack of system to ensure learn, unlearn and relearn

Table 3. Maslow's motivational Model for OBE

SI. No.	Need	General Meaning	To the Education Sector	Course Factors	Strategies
1	Psychological	Most Fundamental factors such as food, water, sleep, and warmth.	If minimum requirements of the course and information are not available, students may not able to study to their full potential.	Ensure the fundamental requirements of course/subjects are met.	Providing course materials such as notes, PPTs, eBooks, Question paper with solutions are provided in advance to ensure minimum requirements are met and students don't have any apprehension bout the subject. Further, the entire course plan will be shared to provide a holistic view of the subject.
2	Safety	Safety, Security, Stability, Protection	Guaranteeing a secure feeling among the students and create a conducive environment for study when they are away from their place/home.	Making sure that students have a feeling of trust about the course and instructor.	Every session is been started with "Thought of the day" and same is circulated in advance among the students through e-platforms to contemplate on it. Established platforms such as Google classroom and WhatsApp groups to respond to the needs quickly. Bringing the awareness about the job opportunities associated with the subjectand importance of the same from the industrial point of view.
3	Social	Love, Affection, Belongingness	Make sure that students' desire for strong peer relationships, cohesive work groups, Friendly supervision are met, and they accepted by others.	Must have the heterogeneous group for the course activity. Also, act as a mentor for the subject.	Heterogeneous groups must be created to ensure student's rotation among the groups, and acceptance by their friends. Also, the notion behind group formation and mapping with POs are delineated to bring seriousness about the activities.

SI. No.	Need	General Meaning	To the Education Sector	Course Factors	Strategies
4	Esteem	Self-esteem, Self-Respect, prestige, status	Ensure that students genuinely feel a sense of achievement and believe that friends see them favorably.	Ensure the instructor provides compliments, individual attention, and recognition for the achievement.	Complimenting/acknowledging/admiring the efforts of the students in the classroom and in the e-platforms (WhatsApp and Google classroom). Bringing the information about students' achievements to the notice of other faculty members, handling the classes for the section.
5	Self-Actualization	Growth, advancement, and creativity	Providing an opportunity for critical thinking and challenging projects.	Paving the way forward for lifelong learning by providing challenging tasks	Establishing group tasks which demand interaction with outside world and insights from students. Providing information, motivating and assisting the students to enroll themselves for MOOCs and other certification courses related to the subject.

Table 4. ARCS Motivational Model for OBE

ARCS Model		Implementation Strategy		
Components	**Sub-Components**	**Objective**	**Expected Outcome (At the end student will be able to)**	**Pedagogy of Engagement**
Attention	Perceptual Arousal	To bring humor to the class with emphasis on importance of planning among the students	Discuss the importance of planning in their personal life within their tenure of engineering life	Showing video related to the importance of planning in their personal life. https://www.youtube.com/watch?v=jliuMgmpGIQ
	Inquiry Arousal	To explaining the purpose planning through the critical thinking	Analyze the purpose of planning in the field of engineering management	Showing a small video of 'Jio' planning to overpower the counterparts https://www.youtube.com/watch?v=4tzArCJ-FMY
	Variability	To tap the ideas/types of business plans for the real-life business	Develop the business plans to sustain and enhance market share for a given product/service	Explaining one most recent business plan reported in the newspaper (The Economic Times) "Zee ties up with Airtel after break-up with Jio" https://economictimes.indiatimes.com/industry/telecom/telecom-news/zee-ties-up-with-airtel-after-break-up-with-jio/articleshow/65466747.cms
Relevance	Goal Orientation	To create the awareness about decision making in the planning premises	Analyze the decision making in planning premises within the present engineering professional context	Showing the panel discussion on Engineering graduates capability in India (Panel discussion in NDTV) https://www.youtube.com/watch?v=oi4BtFTNjg4&t=424s
	Motive Matching	To ensure students plan their career scientifically	Apply the steps in involved in the planning to be equipped with the knowledge, skills and attitude specified by NBA attributes	Provide template describing the steps involved in the planning.
	Familiarity	To benchmark the planning with the strategy of a successful alumnus of the college	Identify and refine the better planning strategy for their personal career	Arranging Skype talk of alumni/Engineering Graduate
Confidence	Learning Requirements	To synchronize the theories with the practical aspects of planning premises	Compare and develop insight about business planning in the present market condition	Interview managers of SMEs regarding steps involved in the planning and summarize in the format of a video.
	Success opportunities	To develop the habit of planning in every minute activity	Apply the concepts and steps of planning in every activity of the given assignment	Submit a comprehensive action plans as per the planning steps discussed earlier involving name of industries to be visited, name of the interviewer, questionnaires and tools used for videography
	Personal Control	Provide expert advise from instructor and	Enhance their plans along with emphasis on better	Arranging a session of better videography tools for the students.

ARCS Model		Implementation Strategy		
Components	**Sub-Components**	**Objective**	**Expected Outcome (At the end student will be able to)**	**Pedagogy of Engagement**
		college video graphics experts	video recording within the available tools.	Giving feedback on students' action plans.
Satisfaction	Intrinsic Reinforcement	To create awareness of planning in St Joseph Engineering College	Summarize the planning activity at different levels in St Joseph Engineering college from the perspective of people at the helm of affairs	Arrange a session from director of the college (Top Management) Arrange a Session from HOD of the department (Middle Management) -------- To delineate about planning activities at the college
	Extrinsic Reward	To enhance the enthusiasm in adopting planning in every footstep scientifically	Apply the planning steps in every activity pertaining to his professional and personal life	Uploading the videos in the college Facebook groups and sending a personal email to their parents regarding their efforts towards learning
	Equity	To learn from one another to enhance the knowledge and skills	Discuss best practices of planning within the given context	Maintaining transparency in grading, by displaying instructor's comments and marks as per the rubrics for every team members' submission.

5. Results and Discussion

Eventually, after the implementation of the OBE based on the ARCS motivational principles, the internal test result was compared with the other section which has adopted the existing approach of OBE deployment. The 2 sample T-test on the internal test, in which the specific module was examined, proved substantial improvement ($p<0.05$) in the effectiveness of the teaching-learning process as shown in Fig. 2. Moreover, it is evident from the Fig. 2 that there is an increase in the average result and decrease in the standard deviation between two sections which have adopted different approaches. Thus, it is evident that ARCS model not only improve the attainment or result but also ensures better understanding among the students by ensuring minimum variation in their comprehension.

Finally, overall attainment of two different sections have been compared to ascertain the effectiveness of Maslow's motivational model for comprehensive OBE implementation. 2 sample T -test has been performed on the overall attainment of two different sections having the same course and research revealed that there is a significant difference ($p<0.05$) in the attainment between new approach and the old one as shown in Fig. 3. But it is evident that even though average has improved, variation is more in the Maslow's method due to its holistic approach of motivation rather than specific to a module.

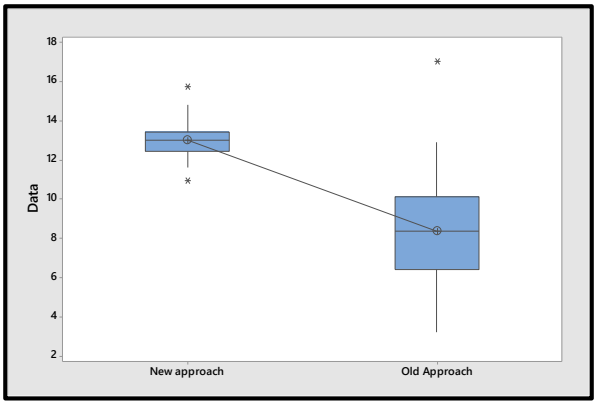

Fig 2. 2-Sample T-test of new and old approch of OBE deployment based on ARCS model

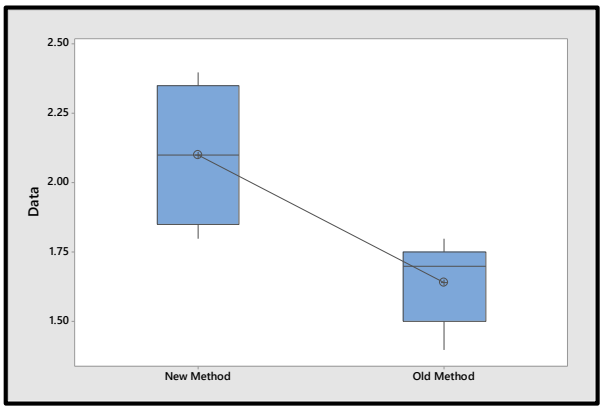

Fig. 3 2-Sample T-test of new and old approch of OBE deployment based on Maslow's model

6. Conclusions

The research ascertains that cross-functional model and industrial best practices in implementation of OBE could provide substantial output. In addition, it is proved that motivation is one of the major hurdles which will dilute the effectiveness of the OBE system and lead to the perception of

'not suitable to the Indian scenario'. The research paves the way forward to discover the applicability of motivational theories in the OBE approach. Moreover, it has opened the new window of opportunity to try and test different frameworks to deploy the OBE approach. Finally, research has assisted to bring out the answer to the RQs.

RQ1: Both Maslow's motivational model and ARCS motivational model can be effectively utilized to deploy OBE effectively.

RQ2: The strategies for the effective implementation of Maslow's motivational model and ARCS motivational model varies in their nature, as former one is more suitable for holistic approach and the later one is better for specific approach in engineering education.

RQ3: Both the methodologies complement each other due to their strengths at different levels.

The present research is limited since, a single case study has been adopted to draw the inference. More case studies with this framework would help to draw more robust conclusion and generalize the results.

Acknowledgment

The authors would like to thank the management of St Joseph Engineering College for creating an ecosystem for carrying our research in engineering education.

References

[1]. General Manual of Accreditation (2019), NBA. Available at http://www.nbaind.org/files/general-manual-of-accreditation.pdf (Accessed on 10 September 2019)

[2]. Manual for Self Study Report (2019), NAAC. Available at http://www.naac.gov.in/images/docs/Manuals/AffiliatedCollegeManual19-03-2019.pdf (Accessed on 10 September 2019)

[3]. Palmer, S. and Ferguson, C. (2008) Improving outcomes-based engineering education in Australia, Australasian Journal of Engineering Education, 14(2), 91-104.

[4]. Sreekanth, N. V., Arjun, C. C. and Guruprasad, K. (2015) Outcome based education: strategies and tools for Indian scenario, Journal of Engineeing Education Transformation, Special Issue, 348-352.

[5]. Mohammad, S., Kassim, A. and Mohd- Yusof, K. (2012) Addressing the issues and challenges in ensuring quality engineering graduates using the Outcome Based Approach (OBA): The UTM experience, ASEAN Journal of Engineering Education, 1(1), 58- 64.

[6]. Rajaee, N. et al. (2013) Issues and Challenges in Implementing Outcome Based Education in Engineering Education, International Journal for Innovation Education and Research, 1(4), 1-9.

[7]. Gero, A. and Abraham, G. (2016) Motivational factors for studying science and engineering in beginning students: the case of academic preparatory programmes, Global Journal of Engineering Education, 18(2), 72-76.

[8]. Michaela, N. (2015) Educational motivation meets Maslow: Self-actualisation as contextual driver, Journal of Student Engagement: Education Matters, 5(1), 18-27.

[9]. Wongwiwatthananukit, S. and Popovich, N. G. (2000) Applying the ARCS model of motivational design to pharmaceutical education, American Journal of Pharmaceutical Education, 64, 188-196.

[10]. Brandt, R. (1993) On Outcome-Based Education: a conversation with Bill Spady, Students at Risk, 50(4), 66-70.

[11]. Spady, W. G. and Aldrine, F. A. (2014) Outcome-Based Education: Critical Issues and Answers, MaxCor, Diliman, Quezon.

[12]. Maslow, A. H. (1943) A theory of motivation, Psychological review, 50(4), 370-396.

[13]. Deci, E.L., Ryan, R.M. and Williams, G.C. (1996) Need satisfaction and the self-regulation of learning, Learn. Indiv.Diff., 8(3), 165-183.

[14]. Gero, A. and Abraham, G. (2016) Motivational factors for studying science and engineering in beginning students: the case of academic preparatory programmes, Global Journal of Engineering Education, 18(2), 72-76.

[15]. Hira, A. (2015) An Ontological Approach towards the next Generation Engineer. Journal of Engineering Education Transformations, 28(2-3), 179-184.

[16]. Keller, J. M. (2010) Motivational Design for Learning and Performance: The ARCS model approach, Springer, NY.

[17]. Aşıksoy, G. and Özdaml, F. (2016) Flipped Classroom adapted to the ARCS Model of Motivation and applied to a Physics Course, Eurasia Journal of Mathematics, Science & Technology Education, 12(6), 1589-1603.

[18]. Hung-Chang, L. and Ya-huei, W. (2008) Applying the ARCS Motivation Model in Technological and Vocational Education, Contemporary Issues in Education Research, 1(2), 53-58.

[19]. Arora A. S. and Sharma, A. (2019) Integrating the ARCS Model with Instruction for Enhanced Learning, Journal of Engineering Education Transformations, 32(3), 31-35.

[20]. Atel, C. M. and Chauhan, D. M. (2017) Motivation Based Engineering Education - A Case Study at RK University, Journal of Engineering Education Transformations, Special Issue.

[21]. Prybutok, V. R. and Ramasesh, R. (2005) An action-research based instrument for monitoring continuous quality improvement, European Journal of Operational Research, 166(2), 293-309.

[22]. Schein, E.H. (2008) Clinical inquiry/research, The SAGE Handbook of Action Research: Participative Inquiry and Practice, Sage, Thousand Oaks, CA.

[23]. Avison, D., Baskerville, R. and Myers, M. (2001) Controlling action research projects, Information Technology & People, 14(1), 28-45.

[24]. Reason, P. and Bradbury, H. (2008) The Sage Handbook of Action Research: Participative Inquiry and Practice, Sage, Los Angeles.

[25]. Efron, S. E. and Ravid, R. (2003) Action Research in Education: A Practical Guide, Guilford Press, New York.