

# Adopting Technology and UDL in Enhancing Effectiveness of Teaching Learning Process

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**Abstract:** *Learner variability in the classroom poses challenges that necessitate analysis by educators in designing effective instructional strategies. Universal Design for Learning (UDL) is a research-based framework that helps educators to plan learning to meet the diverse and variable needs of learners, design a flexible instructional environment, while also identifying and minimizing the hidden barriers to learning. The study adopts a descriptive and conceptual research design, providing an illustration of the methodology to incorporate UDL in the teaching curriculum of higher learning courses in India and different technologies available in this digitized millennium to transform the classroom into a learning laboratory. The purpose of the paper is to highlight the merits of the recent technologies and how they can be integrated with UDL to make learning enduring. The paper highlights a unique pedagogical conceptual model by integrating SAMR model (developed by Dr Ruben Puentedura), UDL and technology to support teachers in designing, developing and integrating learning technologies for high levels of learning achievement. Such a pedagogical model can be considered by educationists to bring a radical transformation in the education system.*

**Keywords:** Educators, Digital learning, ICT, learning, pedagogy, technology, UDL

## 1. Introduction

The present millennium is witnessing radical transformations in the Indian education system since its evolution from the Vedic period dating back to 1700BC. Disruptive innovations and rapid advancements in ICT and digitization have been invading all our lives, mandating the integration of technology in the educational framework. Sustainable development of India's economic system depends on its education system, which was once the best in the world. Radical transformation in the education system and educational policies has been a core agenda for the government, bureaucrats and policy makers. Holistic development of a student from school education to higher education mandates digital technology to be integrated into the teaching-learning pedagogy. Initiatives are being taken to bring about sustainable innovations in education landscape that caters to learner's variability and diminish learning challenges for holistic learning and development. Adoption of technology and digitization in the classroom enhances the scope and depth of learning, as it provides multi-aspect and 360 degree stimuli that targets all the senses of an individual having varying learning capacities, increasing the chances of retention and applicability of the learning. The diversity in economic status (upper income group-lower income group) and geographic origin (urban-rural) of Indian population has been identified to be one of the major obstacles in achieving cent percent literacy rate all over the country.

The last decade has witnessed increase in technology adoption in improving educational services and learning pedagogy to improve the literacy background of this emerging country. VSAT learning programs, online courses, video-based learning, mobile devices and software applications have been integrated with structured instructional learning in improving the teaching-learning experiences. With over a billion people within the spectrum of mobile penetration and over 300 million connected to the Internet, which is expected to reach 550 million by 2018, India has immense potential to digitally educate the masses. The robust development in digital and online

interactive platforms at different levels of learning and integration of advanced technologies into the learning curriculum education are witnessing a rapid rise in enrolment rates, literacy, skill development and added revenue.

Learner variability is the core element of every classroom, with diversity arising from individual differences, family background, geographical origin, social status, cultural differences and special/disadvantaged children (Kavita Rao & Grace Meo, 2016). Inclusion is an on-going process that aims to increase balanced learning among a diverse group of learners by improving access and engagement in learning for all, as well as identifying and removing barriers (IBO, 2010). Universal Design for Learning (UDL), an innovative learning-content designing framework is based on extensive research on students' learning process and learner variability including aspects like cognitive neuroscience, that guides the development of flexible learning environment accommodating the element of individual learning differences and the need for multi-aspect representations or stimuli for higher retention (Rose, DH, & Meyer, A, 2002). In the 1990s, the concept of Universal Design for Learning was introduced by Anne Meyer and David Rose at CAST through their researches on learning dynamics along with digital technologies.

UDL methodology facilitates educators to enhance learning experiences for all learners irrespective of their diverse abilities. According to Meyer, Rose and Gordon (2014) "personal qualities and abilities continually metamorphose, and they not only exist within the individual but in the intersection between the individual and their environment, within a complex and dynamic balance" (p.81). The presence of individual differences in the classroom poses constraints to effective learning, that mandates teachers to consider such issues in planning their structured instructions/lesson plans. It is evident from researches and observations that students process information in different ways and pace, depending on their aptitude and IQ. Students of the same basal age differ in their approach of completing

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tasks and assignments; some are extrovert and excel through effective communication while others are introverts. Rate of comprehension, analysis and application of the classroom instructions vary significantly as all show variations in the way they organize and process information. These factors often emerge as obstacles in achieving student performance and holistic learning and development of entire batch of learners in a balanced manner. UDL facilitates instructions to be accessible to a wider and more diverse range of learners with a higher learning outcome as lessons are designed to include “multiple means for accessing, processing and internalizing information” (Rose & Gravel, 2009).

The goal this new millennium is ‘mastery of learning’, such that education transforms novice learners to innovative expert learners who are intrinsically motivated towards lifelong learning and practical applications. The study provides a comprehensive picture of the UDL methodology and highlights the need and ways to incorporate UDL and advanced digital technologies in the Indian education system in order to make learning more enduring in Indian classrooms. Various foreign universities have produced successful graduates by incorporating UDL clubbed with advanced digital technologies in their education system. The University of Netherlands, California State University, State University of North Carolina, Boston College, Harvard University, George Washington University, University of Southern Maine, University of Kentucky and many other American universities have been found to implement UDL in the curriculum and achieved outstanding results by producing the best talents and charismatic leaders in the world.

A country’s growth is basically rooted in its education system. Hence the key to India’s transformation envisaged in the dreams of Ex-President, Dr. Abdul Kalam lies in the radical transformation of its age-old education system. The education system has to evolve from the rigid syllabus-book based framework to a flexible, choice-based framework that goes beyond books to the adoption of digital technologies in the classroom, learning from varied experiences, integrating Universal Design for Learning and flipping the classroom, so as to deliver multi-aspect instructional learning, making learning an interesting activity and instilling students with the value of self-motivation towards continual learning and development.

## 2. Purpose of the Study

The study aims at providing a descriptive illustration of the UDL methodology and the advanced technologies that are enhancing the teaching-learning experience in foreign educational universities and institutes. The study also highlights a unique pedagogical conceptual model by integrating SAMR model (Puentedura, 2013), UDL and technology to support teachers in designing, developing and integrating learning technologies for high levels of learning achievement among all categories of students. Illustrations of some pedagogical models and emerging edu-technologies that have delivered higher outcomes in education systems have been cited and discussed. Through an analysis of such cases, a conceptual model and initiatives to make teaching

learning a unique experience in and outside the classroom in Indian education system has been recommended for the policy makers. The paper explains how teachers can structure their instructions during the lesson planning stage, adopt technologies in classroom to stimulate the interest of each and every student and make learning retention long lasting for entire group irrespective of learner variability. The methodology proposed facilitates the teacher to analyze academic standards to identify the core competencies and concepts and apply UDL guidelines to the four learning components- objectives, assessments, tools and methods. Based on a thorough analysis the ‘Techno-KSA Model’ has been proposed, that can facilitate teachers to improve the effectiveness of teaching learning process.

## 3. Theoretical Discussion

### UDL Framework

Dr. David Rose at the Center for Applied Special Technology (CAST) pioneered the concept of Universal Design for Learning (UDL) in the 1990s. The UDL methodology as proposed by Meyer and Rose is a flexible instructional system that employs digital technologies making classroom learning effective and eliminating learning deficiencies due to factors of individual differences. This can be used as a standard lesson plan for instructions to be disseminated to the masses, ensuring learning effectiveness for all. UDL is organized based on the three main principles that constitute representation, expression or action, and engagement. These principles are based on the principles of learning sciences and neurosciences. The human brain has three primary brain networks to process and retain learning, which are- Recognition network, Strategic network and Affective network (Meyer et al., 2014). Recognition network is accentuated by multiple means of representation of the information to be learnt, which implies that if the instructions are communicated to the learners through multiple sources that appeal more than one senses of the human body, it results into easy and faster recognition of the stimuli or information. Strategic network is supported by multiple means of expression. This implies that if the learner is been provided multiple opportunities and ways of expression of the learnt information, comprehension and internalization of the information is better and faster. The Affective network is supported by multiple means of engagement, which implies that if the educator employs enough ways of engaging the learners in the teaching-learning process, positive motivation to learn continually can be instilled and the learner is able to relate with the information learnt. Emotional relativity and passion to learn develops the value of self-motivated continual learning in the individual, which is most recommended for the learning process to be effective.

UDL provides learners with multiple means of information and knowledge, alternatives for demonstrating their level of comprehension and multiple sources of engaging the learners' interests, challenge them towards problem identification and solving, and motivates them to learn on a continual basis. UDL provides a set of guidelines that can be flexibly incorporated in the lesson plan or curricula as per the instructional goals, methods, materials/tools and assessments required. Advanced digital technologies can be

adopted to provide enduring learning experiences to all categories of students reducing all kinds of obstacles to learning like- physical, cognitive, intellectual, and organizational barriers. Figure-1 shows the 9 guidelines and 31 checkpoints in UDL that provides the teacher a clear blueprint to develop lesson plans. These facilitate the teacher to design and implement strategies that cater to the academic and emotional (affective) needs of students, thereby resulting in knowledge, skills and attitude development in the students (Isarael, Ribuffo, & Smith, 2014).

I. Representation	II. Expression	III. Engagement
<p>Use multiple means of representation</p> <p>1. Provide options for perception</p> <ul style="list-style-type: none"> <li>Options that customize the display of information</li> <li>Options that provide alternatives for auditory information</li> <li>Options that provide alternatives for visual information</li> </ul> <p>2. Provide options for language and symbols</p> <ul style="list-style-type: none"> <li>Options that define vocabulary and symbols</li> <li>Options that clarify syntax and structure</li> <li>Options for decoding text or mathematical notation</li> <li>Options that promote cross-linguistic understanding</li> <li>Options that illustrate key concepts non-linguistically</li> </ul> <p>3. Provide options for comprehension</p> <ul style="list-style-type: none"> <li>Options that provide or activate background knowledge</li> <li>Options that highlight critical features, big ideas, and relationships</li> <li>Options that guide information processing</li> <li>Options that support memory and transfer</li> </ul>	<p>Use multiple means of expression</p> <p>4. Provide options for physical action</p> <ul style="list-style-type: none"> <li>Options in the mode of physical response</li> <li>Options in the means of navigation</li> <li>Options for accessing tools and assistive technologies</li> </ul> <p>5. Provide options for expressive skills and fluency</p> <ul style="list-style-type: none"> <li>Options in the media for communication</li> <li>Options in the tools for composition and problem solving</li> <li>Options in the scaffolds for practice and performance</li> </ul> <p>6. Provide options for executive functions</p> <ul style="list-style-type: none"> <li>Options that guide effective goal-setting</li> <li>Options that support planning and strategy development</li> <li>Options that facilitate managing information and resources</li> <li>Options that enhance capacity for monitoring progress</li> </ul>	<p>Use multiple means of engagement</p> <p>7. Provide options for recruiting interest</p> <ul style="list-style-type: none"> <li>Options that increase individual choice and autonomy</li> <li>Options that enhance relevance, value, and authenticity</li> <li>Options that reduce threats and distractions</li> </ul> <p>8. Provide options for sustaining effort and persistence</p> <ul style="list-style-type: none"> <li>Options that heighten salience of goals and objectives</li> <li>Options that vary levels of challenge and support</li> <li>Options that foster collaboration and communication</li> <li>Options that increase mastery-oriented feedback</li> </ul> <p>9. Provide options for self-regulation</p> <ul style="list-style-type: none"> <li>Options that guide personal goal-setting and expectations</li> <li>Options that scaffold coping skills and strategies</li> <li>Options that develop self-assessment and reflection</li> </ul>

CAST

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**Figure 1:** Universal Design for Learning (UDL) guidelines version 2.0

Source:

<https://www.uvm.edu/~cdci/universaldesign/udlpdf/CAST3ColumnsFlyer.pdf>

The checkpoints in Figure-1 help a teacher to determine multiple ways of providing physical access, cognitive access and affective access to the learners. Physical access includes the strategies through which students receive information from teachers or expresses them, by adopting presentation combined with voice, multimedia, Artificial intelligence and various other advanced technologies to provide varieties of stimuli in order to induce interest even among the slow learners. Alternatives for visual and audio information using multimedia can be delivered to the learners to grasp their attention and comprehension levels through variations in the methods adopted for response and channelizing through the learning process and using various tools and assistive technologies. Cognitive access involves the provision of support and assignments to the learners to help them apply the learnt information and achieve instructional goals. For example, the check point stating-‘provide options for executive access’ provides opportunities to learners to develop goals, assisting planning and designing learning strategies and monitoring one’s own progress. This usually happens in student assignments, projects and self-learning courses taken up by the learners. Certain checkpoints of the UDL methodology also cater to affective access that fosters student engagement and ownership in the learning process. Strategies that enhance individual choice and autonomy,

enhance goal accomplishment, self-regulation, motivation, initiate self-assessment, reflection, positive attitude and values for ongoing learning. The 31 checkpoints provide the basic road map to a teacher to structure their instructions, making the lesson easily comprehensible for diverse group of learners.

Various universities and institutions have successfully incorporated UDL with advanced technologies in their curricula. In India, although the curricula in any university or institute have not incorporated Universal Design for Learning, but a standard system for preparation of lesson plans is usually practiced by teachers. Various methodologies related to application of UDL in classroom instructional subject matter and curricula have been examined (Browder, Mims, Spooner, Ahlgrim-Delzell, & Lee,2008; Dymond et al.,2006; King-Sears et al.,2015). UDL can be applied to a broadly diversified group of learners, to various levels of curricula and instruction (Rao, K, & Bryant, 2014). UDL integrated withdigital technologies develop self-motivated learning environment with higher academic outcomes and learner engagement (Coyne, Pisha, Dalton, & Smith, 2012; Dalton, Proctor, Uccelli,M. & Snow,2011). UDL have been integrated with the curricula in countries like Finland, Australia and New Zealand even at elementary and secondary grade levels with exceptional academic gains and holistic development of the students, through specific benchmarks and learning objectives (Sargent, Houghton, & White, 2011).

The purpose of adopting UDL in learning instructions is to have a standard curriculum for a diverse group of learners including children with special needs. India, being a land of diversities, is also characterized by a highly diverse group of learners in any classroom. Till 1990, majority of children with disabilities had been excluded from the mainstream education due to several reasons. This is the trend even now with children bearing physical and mental challenges sent to special schools. However, this is much contrary to the objectives of NPE, 1986. The National Policy on Education (NPE,1986) stresses on the need of integrating ‘children with special needs’ with the normal children with the objective “to integrate the physically and mentally challenged with the general community as equal partners, in order to prepare them for normal growth and to enable them to face life with courage and confidence”. Realizing the objective of standardized learning in inclusive classroom settings requires multi-aspect representations, expression and engagement, which can be achieved effectively through the UDL guidelines (Meo, 2008; Sabeena, P. Gopinath & Muthaiah, 2014). Higher effectiveness and academic gains from UDL can be achieved through the integration of advanced digital technologies in the teaching-learning processes. Recently, most of the universities and institutes all over the world have been integrating technologies in their education system. Multimedia representations of the information in varieties of forms, VSAT, online courses, simulations and video sessions through the use of artificial intelligence and various software applications have been increasingly adopted in educational institutes at elementary, secondary, graduate and higher studies.

**Advanced Technology adopted in 21<sup>st</sup> century Classrooms**

Technology has revolutionized the traditional teaching and learning process by accentuating learning effectiveness dramatically. It has the potential to reduce the barriers to education created by ease to access, time, space and ability differences, expanding access to lifelong learning. Emerging technologies such as social media, gamifications, adaptive software etc and emerging teaching practices like openness and user modeling have been heralding scope for transformations in education system and teaching-learning process. Advances in computer and telecommunications led to an increased use of electronic mail, fax machines, the World Wide Web, CDROMs, and commercially developed simulations and courseware in the early 21<sup>st</sup> century, altering the system of education and expanding the missions of colleges and universities. However, the last decade has been witnessing disruptive innovation in the education space through the integration of advanced digital technologies that widens the scope of learning effectiveness. Big data has not only been the buzzword among the corporate but also in the education industry lately. It facilitates the effective tracking of student behavior and provides access to other relevant information that enhances understanding of learning process; strategies that keep them engaged and facilitate retention of information, and how the learning outcomes can be enhanced. Information access in the twenty-first century has been revolutionized through Cloud computing, widening the scope of information access, instructional design and delivery, learner engagement and collaboration. Building a global education platform, involves fostering connections between and among students, teachers, and institutions. Educational institutes all over the world are adopting cloud-based Learning Management Systems (LMS) like - 30 Hands Cloud, Akademia, Brain Honey, Canvas, Chalkable, Concourse, Course Peer, Edustruct, Edvance360, Hybrid LMS, Moodle, Pearson's Schoolnet, Haiku Learning, just to name a few. Cloud computing based LMS synchronize the instruction-based aspects of Collaborative and Social Learning methods with the structured and comprehensive classroom aspects of traditional Learning Management systems. They facilitate multi-aspect representations, expression and engagement, thus being efficient, effective systems allowing self-paced and enduring learning.

Educational technology includes visual models, multimedia, projected and non-projected visuals, as well as audio, video and digital media that provide multi-aspect stimuli to the students (Lever-Duffy, McDonald, and Mizell, 2005). Traditional classrooms have now taken the shape of Digiclass and Smart Classes, while gadgets like laptops, tablets and smart phones have replaced books. Generation Z Students prefer to be more updated, connected and engaged in the changes happening globally. According to Indian Education Sector Outlook survey report, the total number of schools in India is approximately 1.3 million, and about 10% of the private schools have already switched over to multimedia classroom teaching by integrating digital smart class technologies, besides government schools also showing initiation at small scale. Educators are integrating many smart class solutions with exhaustive digital content repository in their lesson plans and instructions, thereby making learning easy, interesting and enduring for the young

learners. Books are available in digital content contributing to the content repository and enabling easy access and portable reading. Artificial intelligence, machine learning, augmented reality and virtual reality is increasingly been used in educational technology integrated smart curricula from elementary level to advanced professional courses and university education improvising the way people learn. According to 'The Future of Internet in India' report by Nasscom and Alamai Technologies, around 75 percent of new Internet users in India would belong to rural areas, which makes cloud and mobile technologies more preferred mode of education in India recently. With online certification courses and distant-online based coaching classes, rural masses are provided with broader scope of getting learnt and trained.

Various EduTech apps are becoming popular among teachers and students. Classroom lessons have been enhanced through the integration of software applications like- TED, Haiku Deck, Intellispace, Evernote, StudyBlue, Duolingo, Remind, ScratchJr, Kahoot, AutismXpress, Socrative, Newsela, Versal, Marqueeed, Aurasma, iMotionHD etc. Applications like StudyBlue allows students to make their own flashcards, upload and organize any notes, add multimedia and assess learning through quizzes. Applications like Blackboard Mobile Learn are among the first classroom-management platforms. Adopting such teaching-learning platforms helps the teacher to develop a conducive and self-motivated learning environment. The integration of technology applications in classroom teaching develops critical thinking ability of the educator as they practice technology integration (Mezirow, 1990) and they develop more expertise in discussing issues requiring critical thinking ability (Schon, 1987).

Adopting technology in teaching-learning process along with UDL integrated into the curriculum facilitates educators to develop an inclusive learning environment providing opportunities for developing essential skills encompassing collaboration, creativity, communication, critical thinking, problem solving, technological proficiency, global awareness and competitiveness. Marqueeed is a user-friendly and intuitive online app that develops visual literacy skills among learners by allowing users to share and discuss images. Another AI enabled app called Aurasma provides an augmented reality platform that uses advanced images and pattern recognition integrating reality with rich interactive content such as videos and animations referred to as auras enhancing the learning experience. Popplet is a collaborative mind-mapping learner-centric app, used by cohorts of students to brainstorm ideas, capture information and learn to create models. Screenshot is a smart whiteboard that records a user's touchscreen interactions and audio. It is used by educators to create mathematics and statistics videos making learning easy, or students can create videos as part of their assignments that help their classmates solve complex equations or problems.

Online courses are also becoming popular due to their ease, convenience and cost-effectiveness in learning and skill development. Being qualified and certified in various higher learning courses from premium educational institutes like the IITs and IIMs is now possible due to the online

certification courses such as – SWAYAM, MOOCs and EdX. Technology has allowed certified learning to be acquired by students, who otherwise are incapable of attending regular classes and afford university education. The Massive Open Online Course (MOOC) is focused on independent, online learners; facilitating self-paced, convenient and enduring learning. MOOCs is been offered by most of the prominent universities of the world like the Harvard University and is gaining popularity and enrolments in India due to the MOOCs courses initiated by IIM-Bangalore in collaboration with IIT-Bombay. The traditional classroom-learning curriculum is now been blended with the digital online courses offered by MOOCs and SWAYAM, presenting a comprehensive aura of learning stimuli to the students. Adopting online courses in the regular curriculum ensures that students develop interest in learning, permitting individualized and self-paced learning.

In 2014, 400 universities offered more than 2400 courses to 17 million students around the world. Online education has gained popularity in India as a career accelerator, particularly in technical fields. In a country of rigid teaching styles and limited university seats, students and professors are finding online learning to be a preferred and effective platform. The two popular providers of massive open online courses, Coursera has 8 percent of worldwide activity from Indian enrollments and EdX has 12 percent. The emergence and popularity of MOOC phenomenon has prompted popular mass media interest to an extent that has not been witnessed earlier with previous educational innovations (Bulfin, Pangrazio & Selwyn, 2014). The potential influence of technology on education has been pervasive with a special thrust of open, online courses been considered as a boon to enhance the status of India with respect to literacy rate and skill development. Top-tier Indian institutes like IITs and IIMs have created free video recorded lectures of more than 700 courses, with the goal of having students at regional colleges in digital contact with the country's most renowned academia, which has brought about a revolutionary transition in the quality of learning.

#### Application of SAMR Model in teaching and Learning

Another effective teaching framework for educators is the SAMR Model for integrating technology into teaching, developed by Dr. Ruben Puentedura (2013), that facilitates teachers to design and infuse digital learning experiences in teaching process utilizing modern technology. "SAMR" stands for Substitution, Augmentation, Modification, and Redefinition. The SAMR model provides a systematic framework for adoption of technology at different levels as per the learner's maturity and interest. The purpose of adopting SAMR framework in one's curriculum or teaching pedagogy is to transform learning experiences with the adoption of optimum degree of technologies resulting in higher learning and student development outcomes. Educators need to create instructional plan with activities that tap the higher-order cognitive skills (as per Bloom's taxonomy) and have a significant impact on student outcomes (SAMR).

Figure 2 shows the four phases of SAMR Model. The first Phase is 'Substitution', which refers to the replacement of old tools, methods and technology with the advanced ones.

Such as the replacement of a white board with a Digiboard with an application like 'Intellispace' to browse through the tools of the application in delivering the instructional content. The second phase is 'Augmentation', that refers to additional utilization of the technology adopted in substitution to save, retrieve and apply learning matter efficiently. 'Modification' is the third phase, where technology integration facilitates to re-design novel portions of the task and transform students learning. This instills creativity and critical thinking abilities in the students. The fourth phase is 'Re-defining'. Re-defining refers to synthesis and evaluation, which are considered to be the highest order thinking skills as per the Bloom's Taxonomy. Students apply their learning and expertise in using technology in designing a completely new task or idea, which is their unique, innovative creation.

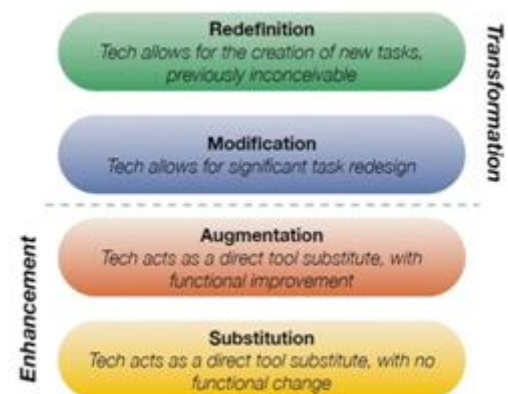


Figure 2: SAMR Model by Dr. Ruben Puentedura

Source: Dr. Ruben Puentedura, 2013. Ph.D.

<http://www.hippasus.com/rpweblog/>

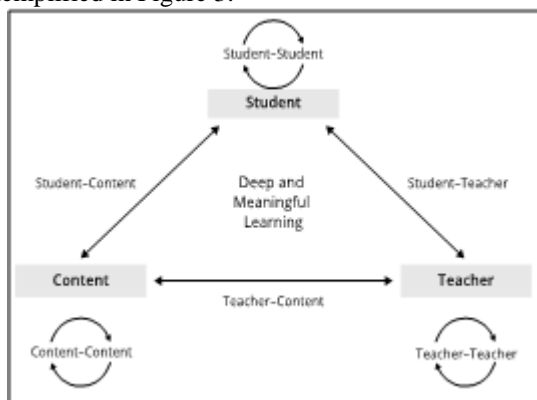
#### 4. Research Framework Applied

The primary objective of this descriptive study is to illustrate the methodology of Universal Design for Learning (UDL) and SAMR as well as the advanced technologies that are becoming inevitable integral tools in the teaching pedagogy enhancing the student's learning outcomes. The study adopts conceptual research design. The theoretical discussion phase of the paper provides a plethora of information on UDL methodology, popular digital technologies adopted in classrooms and the SAMR Model. Based on the analysis of the two pedagogical methodologies, a new model is conceptualized that integrates recent technology with instruction-based learning as per a combination of UDL guidelines and SAMR model that fits well with the diverse requirement of the Indian learners. The paper finally analyses the new model been proposed and attempts to bring out its practical implications and benefits to the educators, learners, society and policy makers. The conceptualization of the novel idea is based on an analysis of secondary information derived from online and library resources and primary data that was gained by interviewing eminent researchers and professors.

#### 5. Conceptualization of the Pedagogical Model

Future of learning is about digital learning spaces and personalized learning. Existing ways of teaching, learning and designing learning environment is inadequate to serve

upcoming learning needs. As technology is radically transforming the way we live, employing emerging technologies and approaches to education necessitates the development of contemporary theories, pedagogies and roles of the educator that suits the inquisitiveness of the Gen Z students. According to Hand (2008) digital technologies are the drivers of development and also a threat in a global information culture, which is considered as a predecessor to disruption resulting to a more modern socioeconomic system and cultural aspects. Anderson & Garrison (1998) had focused on student-oriented interactions in the teaching-learning process for a holistic learning-centric approach. The ‘Learning Equivalency Theory’ based on the three-student interaction concept were more or less considered to be equivalent. Thus through the creation of very high quality levels of any one type of interaction, high quality learning experience could be created, thus eliminating or reducing the other two interactions. Such a concept when combined with the guidelines of UDL and SAMR Model integrating digital technologies can provide an effective framework for planning and executing the learning instructions. Effective learning experience depends upon high-quality interactions, as exemplified in Figure 3.



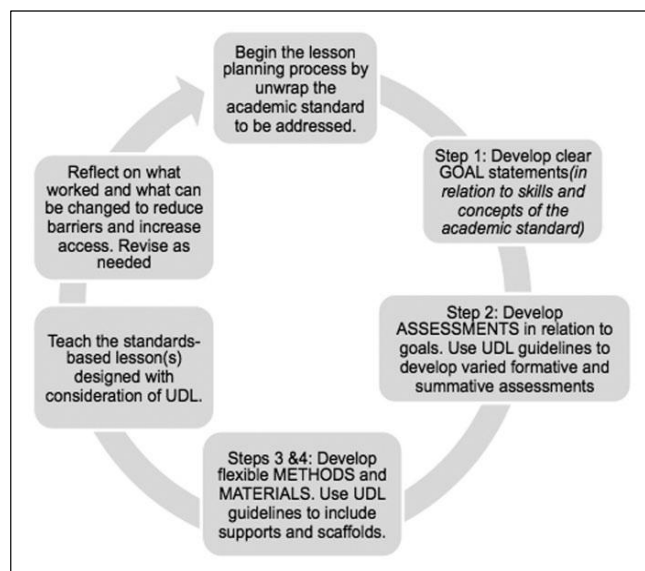
**Figure 3:** Learning Interactions in Learning Equivalency Theory

Source: Veletsianos, G. ed. (2010). *Emerging Technologies in Distance Education*. Edmonton: Athabasca University Press, pp-52.

The pedagogical model proposed in this paper is a framework, which can be considered by educators to plan their instructions/lessons in a structured and standard format for effective delivery in the classroom that would suffice the interest and needs of diversified categories of students. The model is a revision of the ‘UDL cycle of instructional planning’ that is based on the UDL guidelines, and the four levels/phases of the SAMR Model. The revised model is an inclusion methodology integrating technology with a purpose to substitute and re-define traditional teaching-learning process with the contemporary styles of learning. Figure-4 represents the UDL cycle of instructional planning. As per the UDL guidelines of instructional design the diagram exhibits the steps involved in unwrapping standards (re-molding the goals of learning) and designing UDL-based lessons.

Educators formulate lessons/instructions to meet the learning goals and objectives by adopting strategies and resources. They can adopt the nine guidelines and 31 check points of the UDL in designing their lesson plans. As per the

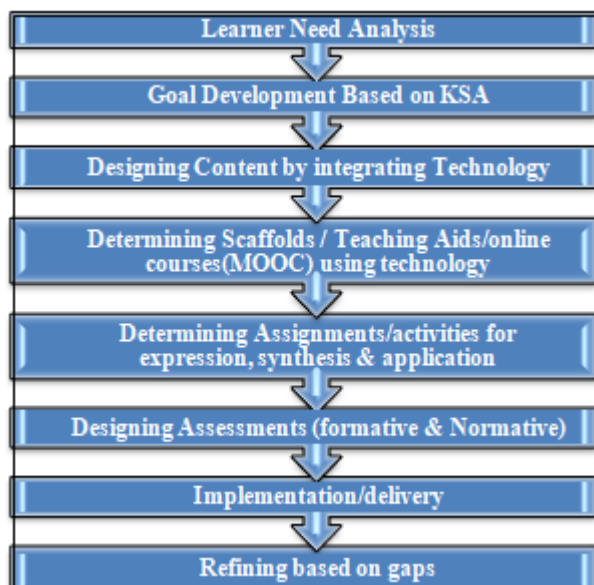
UDL cycle of instructional planning, the standards or broad statements of learning objectives for the students is unwrapped with a purpose to re-confirm the specific knowledge and skills that should be addressed in designing the lessons. Based on these, assessments or activities to evaluate the comprehension, expression and application of the learning is designed (in the form of formative and summative assessments). Flexible methods, tools and teaching aids using different resources and technology is determined to include supporting representations/learning stimuli or scaffolds as per the UDL guideline. These standards/goals-based lessons are delivered to achieve the pre-determined outcomes and then further refined based on the gaps to reduce barriers to learning in a diversified group of learners and increase access.



**Figure 4:** UDL cycle of Instructional planning

Source: Rao and Meo, (2016). *Using Universal Design for Learning to Design Standards-Based Lessons, Student Diversity-SAGE*, pp-5.

Based on the models described above, the conceptual framework or pedagogical model proposed in this study is called ‘Techno-KSA Model’. The model facilitates the development of Knowledge, Skills and Abilities of the students through the integration of technology in teaching-learning process. The UDL model focused on the development of only knowledge and skills, but the Techno-KSA model posited here aims at the development of holistic personality of the students, focusing on Knowledge, skills and ability development, enhancing one’s analytical and creative skills and personal abilities also.



**Figure 5:** Proposed Pedagogical Model – Techno-KSAModel

Source: Author's Analysis

Figure – 5 illustrates the conceptualized pedagogical model, referred to as the Techno-KSA Model. The designing of lessons as per this model is meant to be outcome-based, so as to achieve the goals of effective and enduring learning. The entire process of designing lesson plans or instruction, delivery of the instruction, expression and assessment of the students is conducted adopting appropriate technology, software applications and gadgets. The first phase involves analyzing the nature of learner group, extent of learner variability, categories of students in the group and needs of the learners. It is recommended that educator categorize the learner group as per their IQ and abilities in order to plan and design learning content, scaffolds, assignments, activities and experiences in the lesson. The second phase involves identification of the learning goals. Goals are determined in the form of broad statements defining specifically the knowledge, skills and abilities (technical and non-technical) that are supposed to be developed in the students as a result of the lesson delivery. The third phase focuses on designing the learning content or subject matter instructions by integrating digital technologies like-Proloquo2go, Voice Over, Assistive touch, Closed captioning support, Dragon dictation, Marquee and various other digital applications. The fourth phase involves determining the teaching aids or scaffolds, that facilitate providing multi-aspect representation to the learners and providing them opportunities for multi-aspect expression and application. The applications that can be used are- App writer US, iBooks, Speak it, Typ-O-HD, Evernote, Notability, Intellispace etc. The instructional design might also include blending of online courses like MOOC, edX etc for enhanced and variety in learning experiences to be provided to students.

The fifth phase includes identifying assignments and activities for students' expression to know the extent of learning, student application and assessment. Applications adopted to facilitate students' expression are- Sonicpic, StoryKit, StoryRobe, Pictello, Book Creator etc. The sixth phase includes designing of assessments- formative and

normative adopting technology like Moodle, Online tests, quizzes, and assessment centers etc. The assessments can be designed in such a way that they don't replicate the traditional time-bound written tests. Digital technology and MOOC have offered wide variety of options for assessing the learning effectiveness of the students. The assessment method should be able to answer the question, "How can students demonstrate achievement of the pre-identified goals in variety of ways?". Various methods for assessing can be poster creation, quiz contests, brainstorming, multimedia and oral presentations, case analysis, group discussions or written narratives. Such methods bring in an open learning environment enabling the slow learners to confidently demonstrate their learning and receive positive feedback. Success and recognition of the success in assessments is very crucial for motivating slow learners towards ongoing learning. Formative assessments can be made flexible, following which the summative assessments should be conducted as per the formal assessment policy of any university or institute. A continuous evaluation system is a good option to enhance the performance of the learners and provide ample opportunity to the learner to portray better performance. The seventh phase involves implementation of the lesson plan and finally the lesson plan can be refined from time to time based on gaps identified and students' feedback to improve the entire learning experience through the medium and resources utilized in the process.

The Techno-KSA Model is very similar to the UDL cycle for Instructional Planning. It incorporates the underlying principle of the SAMR Model that through substituting present teaching resources with the advanced and emerging technological resources, and augmenting as well as re-defining the learning experiences for variety of learners, learning can be more effective, interesting and enduring for them. The Model also provides scope for integration of contemporary technology at every phase, so as to meet the needs of modern generation of learners and industry. The model enables to fulfill the objective of developing the interest to learn and cater to the learning needs of wide variety of students.

## 6. Practical Implications

The pedagogy that adopts the recent technologies and contemporary resources and methodologies is the most effective in bringing about enduring learning to the students. The other models of instruction planning and designing discussed in this paper facilitate in providing multi-aspect representation of the information to the immensely diversified learner population. UDL is the best means of supporting access and learning in a diversified learner group. The SAMR model focuses on enhancement of the stimuli communicated for learning to the learner and re-defining the learning experiences for enhanced learning effectiveness. The model is useful in integrating technology at the curricular level and appropriate for interdisciplinary application. Such models have been adopted in designing the program curriculum in many foreign universities to impart outcome-based learning. Indian education system has a huge scope of integrating such models and digital technology in bringing about transformation in the age-old education system.

The Techno-KSA model proposed in this study can be conveniently integrated into the course curriculum and considered by teachers in designing their instructional plans. It can be flexibly mapped to Bloom's taxonomy. This model can be used in conjunction or in place of other backward lesson plan designs. The Techno-KSA model makes learning an interesting and exciting journey for the learners, as the entire process is governed by and immersed in the popular classroom technologies. Most important of all, the Techno-KSA Model facilitates the development of an engaging and truly inclusive education system, providing equal importance to students of special needs.

## 7. Conclusion

Education framework of a country is the key to the nation's economic development and prosperity. It is very crucial for the policy makers, industrialists and researchers to find out ways by which a stronger foundation can be built through effective education, skill development and ongoing learning culture among the present generation. The policy makers and academicians while designing the curriculum should seriously consider the implementation of the contemporary pedagogical models like UDL, Techno-KSA Model and SAMR. Inclusion in the classroom is inevitable in all schools and educational institutes in this global economy where equality is emphasized.

The models discussed in this paper offer a plethora of educational solutions that comprehensively assist schools to leap frog towards an enhanced paradigm of teaching and learning. The quality of education and increasing learning outcomes are the product of amalgamation of emerging technologies, needs of the generation-z learners and the educator's enthusiasm to design the instructions in the most stimulating form, allowing the schools to integrate, nourish, create and enhance a 360-degree relationship with all stakeholders while keeping the student at the center of the learning system. Technology adoption in the learning process stimulates interest in the learners towards self-learning, improves effectiveness of learning among the masses by enhancing access, convenience and multi-aspect means of representation, expression, application and assessment.

## 8. Recommendations

The elaborate discussion of the various pedagogical models in the paper gives an indication to the policy makers and educators that transformations in the Indian education sector are required. It is recommended through the paper that adopting the UDL model, SAMR model or Techno-KSA model along with the emerging technologies improves the student's learning experience and develops a stimulating and enduring learning experience in the classroom.

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## Author Profile



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