

# Embedding Artificial Intelligence (AI) in Futuristic Digital Learning Environment

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## Abstract

With the advancement of technology and the Artificial Intelligence (AI) revolution just round the corner, people social lives have changed so are the ways in which people interact with others using smart devices and also the way they do learning. The situation has become more critical with COVID pandemic spreading around the world forcing people to conduct most of their activities on-line. In these changing times, people are shifting towards digital or ubiquitous learning environments where human interactions are becoming very much rare. Embedding Artificial Intelligence (AI) in Futuristic Digital Learning design makes use of computers, mobile devices, wireless networks along with intelligence based AI applications in our day-to-day life. These communication and networked infrastructures provides a mechanism to exchange knowledge and learn from distant places while on the move at anytime and anywhere intelligently. This has entirely changed the way people are now learning and sharing knowledge.

For embedding AI in Futuristic Digital Learning, a framework needs to be put in place which integrates the applications of artificial intelligence in addition to providing people with a unified platform which can address users' needs in the futuristic digital environments. Being evolving technology, such frameworks are not available at present thus requiring implementing some innovative workable sustainable schemes. The existing themes are based on mobile learning hence there is a need to integrate it with AI applications in order to achieve a futuristic digital learning environment.

This research contribution looked at the existing levels of awareness relating to embedding AI in futuristic digital learning designs and looked at various variables which formed the basis for the development of a framework by the researchers which if implemented by any institution/organization will lead to effective delivery of the futuristic learning Environment.

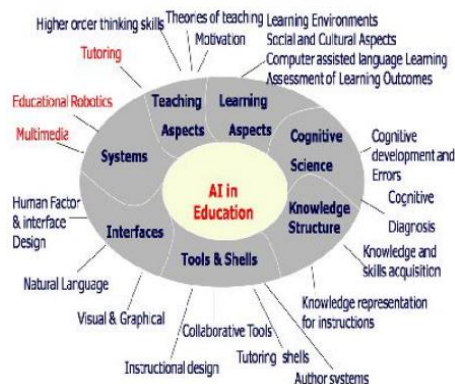
**Key Words:** Artificial Intelligence, Digital Learning, Futuristic Learning, AI based learning.

## Background

AI embedded digital learning (also named as ubiquitous learning) is a latest trend in the world of information and communication technologies. This learning revolution owes its birth to the penetration of a large number of smart devices, which have enormous computational and communication capabilities. Mobile phones and specifically mobile social media serve as boundary crossing tools: tools that are used by learners to generate multimodal representations that reflect their experiences and identities, and to share them across their digital and non-digital social networks. (Pimmer, 2016) [accessed June 20, 2021] titled "Mobile and ubiquitous learning in higher education settings". Information, communication and computing technologies are considered as the main technologies which are leading towards futuristic digital age. In recent years, with the introduction of AI applications, digital learning combined with tiny ubiquitous computing devices has provided great educational effect for users. (Xianzhi Ye, 2008).

The advancements in computing technologies in combination with "always connected" digital world are supporting the expansion of futuristic digital learning. This has led to the procedure of learning from environment much easier. Ubiquitous world is leading the process of sharing of information to take place in a natural way, systematically with consistency and continuity. AI embedded learning is a new and dynamic learning approach, which is an extension of the conventional learning methods. It has become possible because people can now afford the use of digital media. The emergence of AI learning platforms and applications have created new conditions for educationalists, trainers, education professionals and students. The heart of this approach is not the logic or technical specifications of the smart devices, but it is the new ways as to how the knowledge is created,

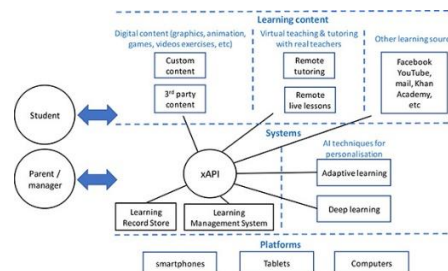
stored, delivered and accessed. A new educational paradigm has begun to emerge which is steering us to take a leading role towards technological innovation. According to (M.Salem, December 2015) the main areas of artificial intelligence in education are shown below;



**Figure 1: The main areas of artificial intelligence in education**  
Source: (M.Salem, December 2015)

The environment of digital learning is providing an interoperable, pervasive, and seamless learning architecture to connect, integrate, and share learning collaborators, learning contents, and learning services (Saadiyah Yahya E. A., 2010). It provides right learning collaborators, right learning contents and right learning services in the right place at the right time. As the effectiveness and efficiency of this kind of learning heavily depends on learners' surrounding context, hence it requires context models and contextual acquisition mechanisms for collecting information at run time (Stephen J.H. Yang. Yang, 2006). It also involves learning analytics, a technique that was developed in the last few years to effectively utilize the huge volume of knowledge. It has proved to be a very useful way to support advanced learning initiatives. An important feature is the learner's mobility and the potential advantage of using learning analytics to enhance digital learning experience.

Futuristic Digital Learning also involves keeping digital records. It allows them to record their activities on the social media and to share the knowledge. By the use of specific tools, one can concentrate on focussed quizzes and find answers to the specific queries. It is significantly attracting interest, especially in relation to its applications in the academic settings. Below model shows the implementation of an AI based education system.



**Figure 2: Implementation of an AI based learning system**  
Source: (<http://www.mobiusconsultants.com/insights/ai-in-education/>)  
Although, as per empirical evidence, broad applications of AI embedded learning is limited at present, however by utilizing the access to digital platforms, enrichment of traditional educational learnings is just round the corner. In future, will see different types of learning technologies adapted which will lead to a paradigm shift from traditional learning methods to high technology based learning methods. This will enable us to access any information from anywhere at any time.

The motivation behind the selection of this area was based on developing a framework for the learning sector (educational institutions, training and development setups) where such kind of frameworks are non-existent. Despite the current market dynamics, there were hardly any business models that implemented the possibilities of Learning Analytics (LA) and Artificial Intelligence (AI) to create adaptive teaching and learning paths (Renz, 2020). This is a completely new domain/area of research in which not much work has been done and there was a dire need to come up with some sustainable framework, which will eventually lead to learning transformations for the future.

### Literature Review

The learning tools for digital learning are the devices and networks detection, tracking, social activities services & accessing the content as defined by (Lyytinen & Yoo, 2002). (Scholtz & Consolvo, 2004) discusses about the computing applications toward developing a framework for the evaluation of digital/ubiquitous computing applications, and come up with a framework for evaluating pervasive applications, which offer a dynamic way of looking at usability and acceptance issues. The transformation is seen from evolutionary perspective as it has empowered human beings to get involved in interactions, which are not dependent on the constraint of physical contact (Geser, 2004).

It also must ensure right services-at right time-at right place. These are based on the learner's environment (Yang, 2006). (Yang, 2006) has extensively talked

about context aware learning Environments. He has discussed as to how this newly designed environment can fully support the needs of peer-to-peer collaborative learning. (Cope & Kalantzis, *Ubiquitous Learning: An Agenda for Educational Transformation*, 2006) explores the facets of this suggestion to acquire old things by using innovative technologies. "Emergence of digital computing creates new conditions for education professionals and Learners". It finds new ways in which the meaning is created, stored, delivered and accessed.

As narrated by (Hwang, Tsai, & Yang, 2008), no obvious definition exists of evolving futuristic learning because of the speedy variations taking place in learning environments. Hence, the researchers have come up with diverse definitions of the terms to define digital ubiquitous learning. This futuristic environment provides a learning mechanism consisting of collaborators, contents, and the services. It relates to providing ways for the identification of right learning collaborators and having the right content. As we look at affordance of the computing infrastructures, we should have a close look to its fallouts. There is a necessity to toil towards bridging the digital rift wherever people cannot pay for buying the state-of-the-art and smart gadgets despite the falling prices (Cope & Kalantzis, *New Media, New Learning*, 2007). In the academic sector, the propagators of ubiquitous/digital computing are working hard to make the technology affordable to the masses.

In *Effecting E-Learning with U-Learning Technology in Nigerian Educational System*, (Boyinbode & Akintola, 2009) talk about learner centered paradigms through the use of communication and computing mechanisms and discusses the use of advanced learning techniques in the Nigerian educational system in order to improve the e-learning initiative.

The definition and characteristics of digital learning: A discussion by (Yahya, Ahmad, & Jalil, 2010) describes new learning paradigm that is reinforced by technologies in computing. It provides fundamental information related to u-learning. Comparison of characteristics and definition of u-learning is also discussed to propose an irrefutable u-learning definition altogether.

In past few years' Mobile technology penetrated at an extraordinary rate. (Park, Nam, & Cha, 2011) Contended m-learning to be relatively an innovative topic of research and its efficacy has yet not been entirely explored. "digital computing evolution catalyzed because of wireless telecommunications

advances, open networking, computing control increase, enhanced battery capacity, and cropping up of flexibility of architecture of software" (Lyytinen & Yoo, 2002). This has led to embedding them in our daily lives; specific to learning activities. (Ogata, Li, Hou, & Uosaki, 2011) Have talked about computer braced learning by apprehending what the learners learn with the relative data. It proposes SCROLL, a logging system for learning. It assists learners for recording of their learning practices by using, audios, videos, photos tags, location, codes and sensor data.

(Aljohani & Davis, *Learning Analytics in Mobile and Ubiquitous Learning Environments*, 2012) defines the learning analytical techniques using advantages to boost mobile and ubiquitous learning situations from a hypothetical perception. It has come up with a mobile learning probing model to examine data for mobile learners. Mobile learning systems strengthen communication, time management, interaction among learners and content delivery in accord with the learners need. Time and place independence and personalization opportunity features of mobile technologies take learners' attention more (Gokben & Yakin, 2014).

Using the appropriate data, one can augment exchanges between mobile devices, learning environments and the learners. The AI embedded learning applications retrieve the contextual data about the learners, hence improving the learners and mobile devices interaction. The material for learning is provided which is based on collected contextual information. The specific contextual data is retrieved to facilitate the interaction using the mobile devices (Aljohani, Davis, & Loke, *A comparison between mobile and ubiquitous learning from the perspective of human-computer interaction*, 2012). The collection of the contextual data is of great significance in making learners more focused on vital tasks to allow saving of time. Mobile equipment's are considered as the latest technological tools that have changed/alterd the socio-cultural fabric and norms of the society in all the spheres of life (Pachler, Seipold, & Bachmair, 2015).

A method of learning where learner effectively begins to learn anywhere and anytime is termed as Ubiquitous learning (Keengwe, 2015). It is based on learning platform, which is structured by Futuristic Computing Technology. The environment is the integration of abstract resources as physical gadgets, humans, places, info-space etc. In other words, a mechanism in which at anytime, anywhere, by using any device anyone can have access to that mechanism is called the new learning environment in the futuristic digital age.

Search in Virtual and Study in Real: A Query/Answer System developed by (Jing, Cheng, & Huang., 2017) uses digital objects in the learning environment providing learner an ability to acquire from more wide-ranging learning innards which include both real and virtual contents. They have discussed about the query/answer system of futuristic architecture with the ability to search and offer learning contents that can be real or virtual. They have come up with a matching algorithm to achieve the proposed solution. Need exists for learner-centric approach and prospects to take care of today’s requirements thus raising scope of m-learning (Irby & Strong, 2015). (Alhassan, 2016) Contends that the highest m-learning added value is dependent on classroom interacting features to the other situations by using the network communication; (Pimmer, Mateescu, & Gröbhel, 2016) talks about connecting of digital mobile media with the increasing access for the traditional forms of higher education enrichment. In 2018, the total no of cell phone subscriptions has crossed more than ten billion subscribers (ITU, 2018). “The ubiquitous learning (u-learning) implementation is a better opportunity in order to address the quality, Accessibility/Availability, and affordability issues present in higher education sector in many countries” (Subiyakto, Hidayah, Gusti, & Hikami, 2019). The table below differentiates between different learning types i.e. e-learning, m-learning and u-learning.

Aspect	u-Learning	m-Learning	e-Learning
Concept	Learn the right thing at the right place and time in the right way	Learn at the right place and time	Learn at the right time
Permanency	Learners can never lose their work.	Learners may lose their work. Changes in learning devices or learning in moving will interrupt learning activities	Learners can lose their work
Accessibility	System access via ubiquitous computing technologies System access via ubiquitous computing technologies	System access via wireless networks	System access via computer network
Immediacy	Learners get information immediately	Learners get information immediately in fixed environments with specified mobile learning devices	Learners cannot get information immediately
Interactivity	Learners' interaction with peers, teachers, and experts effectively through the interfaces of u-learning systems	Learners can interact with peers, teachers, and experts in specified learning environment	Learners' interaction is limited
Context awareness	The system can understand the learner's environment via	The system understands the learner's situation by	The system cannot sense the learner's environment

**Table 1: Differences Between u-Learning, m-Learning, and e-Learning**  
Source: (Suartama, I Kadek & Setyosari, Punaji & Ulfa, Saida., 2020)

Looking at the perspective of the learners’, context can be defined in terms of how learners are affected by adjacent environment. From viewpoint of services, it is stated as the adjacent environment, which affects the delivery of learning services and their implementation. Additionally, with sensing technologies development, it has become likely to gather relevant data including location and time with the use of various technologies like Wi-Fi, Global positioning systems (GPS) etc. This distinguishes the AI embedded learning environment from the mobile learning (ML) environment. Similarly, Artificial Intelligence (AI) and robotics are

likely to have a significant long-term impact on higher education (HE) in future (Cox, 2021).

### Problem Statement

Without having a conceptual framework for the implementation of AI embedded futuristic digital learning environment, the learning paradigm will continue to use traditional learning and training & development infrastructures which are eventually fizzling out. If the new technologies are not embraced through a well-defined framework, the learning and academic paradigms will be greatly affected.

### Significance of Research

The resolution of this learning paradigm shift problem lied in developing a sustainable learning, training & development conceptual framework for AI embedded environment which will serve as a benchmark for systematic sustainable implementations. It can be adopted in any learning environment thus providing a standard benchmark.

### Objectives

Following were the main research objectives.

- To study and analyze the existing technologies relating to AI embedded futuristic digital learning ecosystems with specific emphasis educational learning and training and development environments.
- Developing a AI embedded futuristic digital learning framework to discover relationships between different variables affecting learning adaptations.
- Applying statistical analysis on the collected questionnaires and by validating the developed research hypothesis.
- Developing a new innovative learning framework.

### Proposed Method

#### The Platform

The platforms studied in this research were following;

- Research (Journals) Publications
- Web Resources
- Books
- Visiting Learning Establishments

These platforms were selected because of the influence they carry relating to the proposed area of research.

### Research Methodology

- Quantitative method was applied for this research.
- Questionnaire / Sample based survey was conducted in this research as methodology.

### Survey Instrument

The instrument was devised after the thorough study of the previously conducted researches relating to the research topic. A survey was conducted to help gain reliable data from the respondents. Survey questionnaire analysis was based on the Likert Scale Ratings.

### Research Methodology and Design

#### Research Framework

Based on the literature review and as per the defined variables of Permanency/Continuance, Accessibility/Availability, Immediacy/Speediness, Interactivity/Interactional, Context Awareness/Context Sensitive and Concept/Flexiblens (Zolkefley, Tahir, Lokman, Aziz, & Sharif, 2015), a conceptual model was developed for the learning enviornmrnt in the learning establishments while embedding AI based environment including its available tools and applications in learning. The research methodology followed the following broad steps;

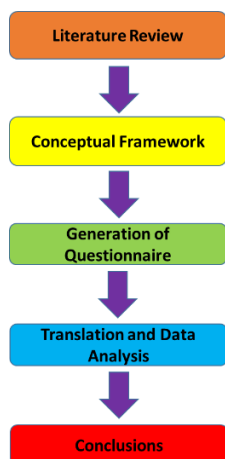


Figure 3: Data Gathering Process  
Source: (Saunders, 2009)

The research came up with a framework/model which at present was not available. It covered the topic of research and integrated various variables together to

make a sense out of it after applying the relevant validity, reliability, regression tests etc.

### Research Model

On the basis of the research framework and the literature review, following was the proposed research model.

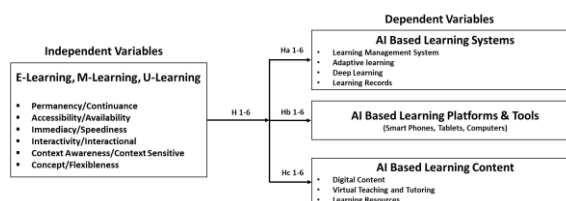


Fig 4: Research Model

The six independent variables identified under the E-Learning, M-Learning, U-Learning in the above model were Permanency/Continuance, Accessibility/Availability, Immediacy/Speedines, Interactivity/Interactional, Context Awareness/Context Sensitive and Flexiblens. The three dependent variables selected are AI Based Learning Systems (Learning Management System, Adaptive learning, Deep Learning, Learning Records), AI Based Learning Platforms & Tools (Smart Phones, Tablets, Computers) and AI Based Learning Content (Digital Content, Virtual Teaching & Tutoring, Learning Resources).

The research assessed level of awareness of futuristic learning and analysis contribution of different factors (variables) responsible for its rate of adoption. The outcome of the research work lead towards coming up with a framework which if applied in any academic/learning/training setup will lead to the effective delivery of the futuristic AI embedded digital trainings.

The dependent and independent variables relation were studied. There are many approaches to data analysis. First, the validity and reliability of the method is essential in research data collection. Reliable measuring method gives the similar extents when one repetitively measures the similar objects or the events that remain unchanged.

Similarly, Cronbach's alpha may be defined as the measurement of the internal consistency i.e. how much in close relationship a collection of items is in a group. It is a measure of the scale reliability. If we look at the

frequency distribution of an observation, it is the total number of occurrences of observation in a given data.

In statistics, Pearson correlation coefficient measures linear correlation between two variables. Regression analysis is also used for finding relationships between the variables. It comprises of many techniques for modeling & analyzing variables i.e. both dependent and independent. SPSS was used for statistical analysis.

### **Research Hypotheses**

**H1a,b,c:** In the learning environment, Permanency/Continuance is positively related to the presence of AI Based Learning Systems (Ha1), AI Based Learning Platforms & Tools (Hb1) and AI Based Learning Content (Hc1).

**H2a,b,c:** In the learning environment, Accessibility/Availability is positively related to the presence of AI Based Learning Systems (Ha2), AI Based Learning Platforms & Tools (Hb2) and AI Based Learning Content (Hc2).

**H3a,b,c:** In the learning environment, Immediacy/Speediness is positively related to the presence of AI Based Learning Systems (Ha3), AI Based Learning Platforms & Tools (Hb3) and AI Based Learning Content (Hc3).

**H4a,b,c:** In the learning environment, Interactivity/Interactional is positively related to the presence of AI Based Learning Systems (Ha4), AI Based Learning Platforms & Tools (Hb4) and AI Based Learning Content (Hc4).

**H5a,b,c:** In the learning environment, Context Awareness/Context Sensitive is positively related to the presence of AI Based Learning Systems (Ha5), AI Based Learning Platforms & Tools (Hb5) and AI Based Learning Content (Hc5).

**H6a,b,c:** In the learning environment, Concept/Flexibleness is positively related to the presence of AI Based Learning Systems (Ha6), AI Based Learning Platforms & Tools (Hb6) and AI Based Learning Content (Hc6).

The research was based on the existing body of knowledge. The researchers reviewed the literature by going through previous studies resulting in the development of a conceptual framework by following established scientific processes. Fundamental laws of hypothesis were used on which are based observations in order to determine the validity of the conceived hypothesis hypotheses. The research work used

various empirical tests. The targeted population was studied in order to generalize the researched findings. Following tests were performed in the research work:

1. Validity Test
2. Cronbach's Alpha
3. Frequency Distribution (data)
4. Descriptive Statistics
5. Pearson Correlation
6. Regression Analysis

For statistical analysis, package of SPSS was used by the researcher. SPSS was used to find Cronbach's Alpha Coefficient aiming to find how much reliable is the method for the collected data (questionnaire's). However, before we apply Cronbach's Alpha Reliability, it should be ensured that all independent variables, measuring the dependent variables are in the same direction; i.e., there exists no negatively items in the developed questionnaire. The core data collection phase employed survey questionnaires. In this research, a cross-sectional survey with self-consummation surveys was regarded as the most suitable technique for data collection. In this way, they were utilized to accumulate the required knowledge in ubiquitous learning, and to distinguish the impacts of the various factors and their speculated relationships.

Study research design was evocative and comprise of transverse design. This evocative study is linked with characteristics explanation related to population of the subject. The relationships discovery between several variables was carried out for determining whether variables were unrelated or independent. If related, it stays necessary to determine the existing relationship strength. Carefully selected questionnaires were asked from selected participant separately. Moreover, research studies was carried out to denote at that time a snapshot of the research. (Cooper & Schindler, 2008).

The method validity was measured through questionnaire's testing by the use of data collected by preliminary study. The preliminary test was conducted for the refinement of the questionnaires so as the respondents do not feel a problem in giving answers to the questions, the clarity of questions was established and there existed no problem regarding the accurate recording of the data. The result of data validity evaluation were collected (Saunders, Lewis, & Thornhill, 2009). In addition to the above, the questionnaire were shown for review to some subject experts.

Similarly, the internal validity is defined as the research method measurement ability of what it is planned to measure and consists of many types.

Validity of the content is defined as the degree to which the method offers ample investigative questions coverage. The validity based on a certain criterion explains the success of measures utilized for the predictions / estimations. Lastly, the validity of construct takes care of both the theory and the measuring method which is being used. (Cooper & Schindler, 2008).

Reliability was tested by calculating Cronbach's Alpha, which can take any value ranging from one (complete internal consistency) to zero (no internal consistency) whereas 0.7 is defined as an acceptable limit. As per (George & Mallery, 2003), the following rules apply.

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Table 2: Cronbach Alpha (Reliability Limits)

### Target Population

The samples were gathered from the following four establishments based on their academic and learning infrastructures.

### Academic

Abasyn University (Private Sector)  
NUML (Public Sector)

### Learning Organizations (Training and Development)

PTCL/UFone Group  
Telenor

Total no of questionnaires distributed were 200. Fifty (50) questionnaires were distributed for each establishment.

### Data Collection

In the research study primary data gathering procedures were used.

### Data Analysis & Presentation

Regression analysis was carried out to produce the nature and magnitude of existing relationships among

variables of the research and for testing of the hypothesis relationships. Descriptive statistics i.e. percentages and frequencies were computed to describe variables main characteristics. Likert scale kinds of questions were used for calculating Mean scores. The below table shows the statistical tests that were performed.

Hypothesis	Objective	Tests
H1 <sub>a,b,c</sub>	In the learning environment, Permanency/Continuance is positively related to the presence of AI Based Learning Systems (Ha1), AI Based Learning Platforms & Tools (Hb1) and AI Based Learning Content (Hc1)	Pearson's Product Moment Correlation Analysis Simple Linear Regression Analysis
H2 <sub>a,b,c</sub>	In the learning environment, Accessibility/Availability is positively related to the presence of AI Based Learning Systems (Ha2), AI Based Learning Platforms & Tools (Hb2) and AI Based Learning Content (Hc2)	
H3 <sub>a,b,c</sub>	In the learning environment, Immediacy/Speediness is positively related to the presence of AI Based Learning Systems (Ha3), AI Based Learning Platforms & Tools (Hb3) and AI Based Learning Content (Hc3)	
H4 <sub>a,b,c</sub>	In the learning environment, Interactivity/Interactivity is positively related to the presence of AI Based Learning Systems (Ha4), AI Based Learning Platforms & Tools (Hb4) and AI Based Learning Content (Hc4)	
H5 <sub>a,b,c</sub>	In the learning environment, Context Awareness/Context Sensitive is positively related to the presence of AI Based Learning Systems (Ha5), AI Based Learning Platforms & Tools (Hb5) and AI Based Learning Content (Hc5)	
H6 <sub>a,b,c</sub>	In the learning environment, Concept Flexibility is positively related to the presence of AI Based Learning Systems (Ha6), AI Based Learning Platforms & Tools (Hb6) and AI Based Learning Content (Hc6)	

Table 4: Hypothesis Statistical Tests

### Questionnaires

A questionnaire were developed against each independent and dependent variable.

### Data Analysis

Reliability statistics were carried out with every item extends above a 0.70 value which shows the strong reliability of the scale of measurement and questionnaire strength. Descriptive Statistics pertaining individual variables which represents herewith contains the number of observations under each item, the minimum, maximum and the mean value found through the use of software and the standard deviation presenting each item variation. Items for each variable dimension were observed through the questionnaire ranging values from 2 to 5 and a variation of almost 0.5 to 0.65.

- 45% of the respondents agreed to the fact that the required information is always available in the Futuristic Digital Learning Environment.
- The information available can be used for AI based ubiquitous computing was agreed by 73% of the respondents. 14% were not sure depicting their lack of knowledge about AI.
- In the AI enabled Futuristic Digital Learning Environment, the key to success is the Flexibility of new technologies to access the information, no matter how many years back the information was uploaded. It showed strong agreement.

- The availability of information 24/7 was supported by almost everyone as key to success.
- The availability of knowledge that is up to date is perceived as challenge to majority.
- The information can be assessed through the use of smart phones, landline networks, wireless networks and other innovative products Futuristic Digital Learning Environment was agreed upon by overwhelming 94%.
- The learning information is available immediately from anywhere showed mixed views with 60% respondents not sure about it.
- Immediate availability of information helps the users to use online computing resources from live networks was strongly agreed.
- Immediate availability of information can be guaranteed if one has the proper technological tools (including AI) to access that information. This was agreed upon by majority of the respondents.
- Learners can easily interact with experts, Trainers, or peers showed disagreement owing to the ground reality about their availability.
- Subject gurus/experts are easily available was in line with the previous observation regarding question mark on their availability.
- Knowledge is easily accessible was agreed upon by majority.
- Real world environment provides Futuristic Digital Learning Environment functions as was agreed by most of them.
- The question related to if the system can sense or detect different context of learners during the learning process and implement the activity of the system with the user cannot be comprehended by majority 64% with limited understanding of the users because of non-exposure.
- With the advent of smartphones or various applications, trainees can play with these gadgets anywhere they are but around 20% were not exposed to its advantages.
- Learners can get the right information at the right place in the right way experienced a mixed response.
- The availability of information at the right place in the right way helps take speedy decisions based on conceptualized and adaptable parameters was agreed upon by more than 78% for the respondents.
- On the question of adoption of new technologies (including AI) is no longer a barrier to change the learner's concepts and mind-set was agreed upon more than 54% of the respondents.
- Futuristic Digital Learning Environment is context-aware, which provides adaptive and personalized support to the learners in the right way, in the right place and at the right time.
- Futuristic Digital Learning environment supports problem-based learning was supported by 70% of the respondents.
- Futuristic Digital Learning Environment improves trainees learning of critical concepts and ideas.
- Futuristic Digital Learning environment helps accommodate trainees personal learning styles.
- Futuristic Digital Learning Environment under AI is currently emerging as an important element of wireless communication and sensing technologies was not totally agreed upon by the respondents because of non-exposure to benefits of AI in the coming future.
- Intelligent AI based environment is mainly achieved through Permanency/Continuance, Accessibility/Availability, Immediacy/Speediness, context-awareness and concept/Flexibleness was accepted and agreed upon by majority of the respondent i.e. 69%.
- Combining physical, contextual, and functional prototyping techniques to generate compound prototypes and situated



experience prototypes, or para types, can be particularly useful for mobile and ubiquitous computing AI applications.

- Learners are willing to help colleagues or other trainees as much as they can when they face problems using AI based scenarios.
- AI embedded technology is being used in the development of strategies for solving problems in the real world was not agreed upon by 45% of the respondents. This owes to people not familiar with AI implementations.
- AI based technology tools utilize resources for managing and communicating information was agreed upon by the majority of respondents i.e. 72%.

## Conclusions

The researchers have come up with a framework which takes care of the dimensions of Permanency/Continuance, Accessibility/Availability, Immediacy/Speediness, Interactivity/Interactional, Context Awareness/Context Sensitive and Flexiblensness. The previous research lacked their integration. The framework gages the level of awareness and has concluded after thorough analysis that the above-mentioned factors have a great impact on the adaptation of Futuristic Digital Learning Environment. The designed framework will act as a yardstick or a benchmark for any company wishing to apply the same framework with tailor made modifications to fit into their respective work environments.

The study contributed to the understanding of the existing technologies relating to Futuristic Digital Learning Environment ecosystem with embedded AI with specific emphasis on ubiquitous learning for selected organizations. It has further come up with a AI embedded Futuristic Digital Learning Environment framework which can be adopted by any entity wishing to establish AI echo system. Developing a new innovative Futuristic Digital Learning Environment framework based on the research findings is innovative and can be adopted or tailor made thus providing a basic benchmark standard.

## Future Research

The framework should be extended to other organizations and regions of the country to come up with new frameworks which can help in designing and

coming up with a future policy pertaining to AI embedded Futuristic Digital Learning Environment.

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