Enabling Enactive Learning to Implement Modeling, Simulation and Training Technologies

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ABSTRACT

The leap-ahead rates of technology development are only going to increase with time. Many of these technologies fall into the category of Modeling, Simulation and Training. Developers and engineers are working tirelessly to push the envelope in these areas to enhance the training and education of learners. Conversely, learning as a science is gaining momentum as the cognitive sciences develop and more is known about the mind, body and learning. Enactive learning is the bridge that will enable these emerging technologies to be implemented into the learning landscape. The industrial learning models, methodologies and design must change to become a learner pathway that is adaptable, personalized, and specific to the individual. Doing so will allow learners and facilitators of learning to be able to utilize these tools and enactive learning to enhance training and education and be able to gain ground in learning efficiencies. This paper aims to discuss a shift from instructional design modes to that of enactive learning, as well as open pathways for implementation of these learning technologies, and discuss how facilitators with a purposeful intent towards a more enactive learning environment will benefit the learning landscape.

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INTRODUCTION

The educational settings of the present as well as the future are faced with the understanding and implementation of technologies into the future learning ecosystem. The future learning ecosystem is an environment for learning that is going to rapidly change from the learning models of yesteryear and need to be molded to shape tomorrow's learner for the future society that awaits them.

The current K-12 educational system is designed to be a standardized industrial model to accommodate the masses and produce a throughput of as many competent students as possible to a myriad of changing standards. This is often under a finite time constraint, and without concern for personalized learning, nor is it found to be adaptable or flexible to the individual, barring a remedial process of repeating a grade level because it lessens the opportunity for shared learning and discourse between students in the course of learning (Garrison, 2000).

There are, however, other situations in which neither the school system, the instructional facilitators, or the students themselves can overcome learning that is interrupted and are left with tough decisions. This was the case in eastern North Carolina in the Fall of 2018. Hurricane Florence spent more than 36 hours flooding the eastern portion of the state. Portions of the state from I-95 east spent between six (6) to (8) weeks out of the classroom, and some will never return to their schools due to condemnation. While this is to be considered an act of God, in the eyes of insurance agencies, for educators, they were left with a question of what to do with the students. Do they cut the curriculum short? Would they be faced with extending the school year by that much time? How would they handle remediation? It was almost like starting the school year all over again (Duff, 2018). Contrast this in a future learning ecosystem in which students would be able to have individualized, or personalized learning at their fingertips in a seamless learning experience.

This, however, is not a new method. Enactive learning is comparable to that of experiential learning, or learning by doing, which was fathered by John Dewey. Enactive learning takes on the role of an action-based process, often and is a bridge that integrates brain, body and the learning environment (Gallagher & Lindgren, 2015). The potential for success though is reached when combining the merits of enactive learning with these emerging technologies and training aids, such as simulations and simulators. These training aids and devices, when implemented into curricula correctly and with a purposeful and proactive instructional design can lead to success on the part of the learner.

TRADITIONAL INSTRUCTIONAL SYSTEMS DESIGN

The systems approach of Instructional Systems Design (ISD) was originally developed by Florida State University in the early 1970s for use by the US Army (Watson, 1981). This method utilizes the ADDIE model for designing instructional curriculum. The five-phase model consists of: Analysis, Design, Development, Implementation and Evaluation (Peterson, 2003). Taking from the trend of this model, ISD has taken exactly that, a systematic approach to designing instruction that feels more like an industrial model approach.

This model, and those like it are responsible for leading Instructional Designers (ID) through a process, in which they have been tasked with turning the theories and principles of learning into the methods, techniques, materials and activities of learning that will be the instruments for transferring knowledge to the learner (Ertmer & Newby, 1993).

The question is whether these IDs have the appropriate tools, methods, and theories to be able to do the job for a future learning ecosystem. The learning process is a complex one without needing to inject the emerging tools and technologies that are being designed and developed every day. The theories that are being utilized still today, have deep roots into the past, and that creates problem because the researchers did not have these technologies to consider when creating these theories (Ertmer & Newby, 1993). The question of where knowledge comes from and continuing to improve the understanding of the cognitive process will continue to develop over time and potentially into new learning theories.

The training of the IDs will need to consider the former theories, as well as be able to consider the future needs of students, in a personalized learning environment. Current environments, and largely pedagogical techniques focus on a passive learning experience first, to provide information to the students before they can apply the information (Raymond, 2010). If they can apply it at all. This is a growing concern, because the gap or delay between receipt of this knowledge and the application degrade the learning process. As such, IDs and facilitators alike, in their training, need to consider their preparation as well as these time gaps.

Further, in the military, methods of lecture, demonstration and practical application might also set a precedent in the wrong direction for these IDs. The passive style of learning reduces the impact on students, where lecture is one-way, and even a demonstration, while letting them experience the instruction through observation, their ability to learn from this is still diminished (Herbelin & Ciger, 2008). Instead, the IDs should be trained in methods and techniques to engage students early on, and expose them to the learning technologies earlier, not just to engage them, but to increase their self-efficacy with the technology itself.

ENACTIVE LEARNING

The term *enactive*, as it relates to cognition was developed by Jerome Bruner, who used the term referring to bodily and spatial activity as an aspect of cognitive development (Kaipainen, et al., 2011). As a system, however, it is described as one that blends dynamic human and technological processes which creates an embodiment of mind and technology. The key item with Enactive Learning (EL) is that it is a product of the interaction of the human body, mind and learning environment around it, to include any learning technologies utilized in the delivery of instruction.

EL is gaining momentum in cognitive science but borrows from forefathers of education, like John Dewey. Dewey's work of learning by doing really embodies what is referred to as enactivism (Gallagher & Lindgren, 2015). The key point about EL is to take into consideration the way that the learner interacts with the experience and considers it to construct a meaning out of it for the purpose of learning.

The enactive approach has main background assumptions as well, that are important to consider in the design of instruction, as well as the delivery. Among them, are the assumptions that the approach works to cross the brain-body-environment, as well as to aim towards higher-order cognitive functions, such as reflection (Gallagher & Lindgren, 2015).

Enactive Learning Affordances

Enactive Learning does provide affordances to the learner, if they are planned for during the design of learning. A goal of learning and maturation of a learner is to get them to a point at which they are responsible for their learning and can self-regulate their own learning. The ability to self-regulate is achieved more rapidly in learners that feel that they are active participants in their own learning process and can direct their learning efforts instead of solely relying on a facilitator (Zimmerman, 1989).

Zimmerman (1989) goes on to define *Self-regulated learning* as those actions and processes directed at acquiring information or skill that involve agency, purpose, and instrumentality perceptions by learners. Further, Zimmerman (1989) notes Bandura's (1986) definition of *Self-Efficacy* as perceptions about one's capabilities to organize and implement actions necessary to attain designated performance of skill for specific tasks. These definitions are important because the learners must be able to have confidence in their abilities to accomplish the task or understand the learning before they can begin the journey towards self-regulation. EL can play a key role in developing these capabilities by providing a motivational, engaging, and active learning experience to support the achievement of these goals.

Engagement and boredom theory research demonstrate that higher levels of arousal are important in the enhancement of learning, particularly in retention through memory studies (Vogel-Walcutt, Fiorella, Carper & Schatz, 2012). Other studies have now demonstrated that enactive learning in which the learner is an active participant in the learning intervention is shown to increase the comprehension of the information that is presented (Gallagher & Lindgren, 2015).

The implementation of training aids and systems is often regarded as tools to further engage or make the learner an active participant in their learning, yet they are not automated in their abilities to automate increased learning efficiencies. In fact, many variables from knowledge of utilizing the system, to time afforded for use of the system could greatly affect the system's ability to achieve the goals that it was designed for.

Timing Considerations with Enactive Learning

The potential for EL to support learning regardless of environment or time, or location, through these training aids is high. A future learning ecosystem can provide an environment for learning in which a learner is no longer constrained within a given timeline which in practice is more like a ticking clock with a finite end.

Think back to the example of the K-12 students in North Carolina mentioned earlier. Had they the ability to deliver personalized learning at the point of need, they might have been able to salvage more of the learning year. Contrary, most school systems are tied to the rigidity of a highly structured curriculum and timelines (Zimmerman, 1989). EL could enhance the ability of parents, educators and students to have more autonomy on the delivery and pace of their programs of instruction. Personal Electronic Devices (PED) provide the opportunity to disrupt current boundaries and limitations of education. In the future, this could then be taken from a rigid standardization among the masses, to a more adaptable version that allows those that know the specific learner best to have at least partial control of their ability to master the learning outcomes.

IMPLEMENTING TECHNOLOGY THROUGH ENACTIVE LEARNING

The leap-ahead pace of technology creates immediate gaps in the social classes across the country's landscape of learning, let alone in the classrooms. However, there is a need for these tools, particularly to create a more experiential learning process. Considerations should be given to the selection of these tools, how the tools will be used, and ultimately focusing on where they will enhance learning.

Learning Technology Trends

The first consideration is in the review of available learning technologies, and emerging trends for education. While there is a felt need for these training tools, it is more important that the training tool clearly assists in the learning process (Bell & Kozlowski, 2008). The landscape is littered with these learning technologies at every turn, and the ID or facilitator should not be caught up in chasing a shiny object but doing due diligence in the review and selection of the tool. These vary from simple to complex applications for use on PEDs, to full-blown Learning Management Systems (LMS) such as Canvas or Blackboard, which contain entire courses of instruction.

When looking at these training aids, it is important to consider the characteristics of the tool. Who was the tool designed for? For instance, if it is a tool that was designed to teach land navigation to soldiers, it might not readily translate to teach orienteering to Cub Scouts. Consider the availability of the tool. Is it a tool that can only be downloaded onto an Android system? Is it restricted to iOS? Is there a Section 508 compliant version of a web application for the software? More importantly than the features of the technology though should be the consideration of the structure of the system, and its relationship to the learning need (Gupta & Bostrom, 2009).

This is often an issue with the gamification of learning, in that the games often come to the forefront, in the design, instead of consideration for how much content of learning is being delivered through the vehicle of the game. These items must also then be considered when making selections, and later, when reviewing the Return on Investment (ROI) of the training aid.

Another consideration is that the need for immediacy with education can often be an issue with these technologies. In other words, if the developers are rushing to create a widget, software, or tool, that they miss items of usefulness in the tool, or have not completely fleshed out issues that a user may have. The preponderance of computer based aids particularly drive a need for ensuring that the computer based tool is able to provide encouragement or useful direction to the user in cases where responses normally would have required someone to interpret, such as a "404 not found" error on a web page (LaRose & Whitten, 2000).

Additionally, consideration for these tools must also build in the potential for future adaptability as well as personalization. Biosensors, and bioinformatic feedback can be the future of learning, or may be an area in which the learning environment is driven by physiological responses that are fed back into a system, which would then drive or adapt a different pathway, for the learner, through a program of instruction. Considerations must be given to the type of technologies to drive enaction, that will have the availability for use of sensors to track physiological factors, or behavior, as well as being able to house a repository or database that is able to drive content based on the biological feedback that is received (Kaipainen, et al., 2011).

Facilitating in an Enactive Environment

The creation of an EL environment, as well as considering utilization of learning technologies, has several items to consider- both for the ID and the facilitator. First and foremost, this requires some thought on the part of the ID in the design of the course, as well as the boots-on-the-ground approach that is led by the facilitator. Teaching in virtual worlds is different than that of typical pedagogy and andragogy, because of the social and cognitive aspects that come with it. Facilitation of EL, first must be structured to allow flexibility of the facilitator to be able to then have the availability to introduce and implement learning technologies, and before that can occur, IDs must provide a program of instruction that can accommodate these needs.

The ID will need to consider how the facilitation should happen from a strategic level. This should have a natural flow which will not be inhibited by being too rigid, but instead provides a structure, with flexibility. One such model is characterized by structuring the learning in phases. These phases include the teacher-facilitated classroom activities; out of class individual or small group activities; online or in-class data sharing or peer learning; and in-class consolidation activities (Milrad, et al., 2013). What this method allows for is a multi-dimensional approach to learning which provides the ability to implement these learning technologies in various settings which can increase self-efficacy. Allowing the learner to work on their own, and then with their peers, and then allow them to return, consolidate and reflect on their learning, is a method that provide a comprehensive learning experience to the learner.

Increasing the learner's self-efficacy is an important component of the facilitation, in improving the learning experience because of the weight of the learner's perception of their own abilities. The facilitator must consider the learner's perception of their own ability, and not just their actual ability when making considerations on how to incorporate technologies into an EL environment (Hodges, 2008).

To do this, it requires a facilitator that can perform many roles in the learning process. These four roles are described as: Educator as Master Artist; Educator as Network Administrator; Educator as a Concierge; and Educator as a Curator (Siemens, 2008). The Educator as Master Artist means that the facilitator of learning is observing the learner's activities and calls attention to their innovations, and methods of problem solution. This means that the learner is not solely relying on the expertise of the facilitator for instruction. The Educator as Network Administrator provides the facilitator in a role of assisting the learners to make connections for learning networks, which should drive them towards achieving the competencies in the course. The Educator as a Concierge is like the colloquial guide on the side. This facilitator gives guidance when needed but allows the learners to explore on their own. Lastly, the Educator as Curator is a dual approach, which allows the facilitator to maintain their expertise in the area, but also provide guidance which fosters learning and encourages the learner to continue to explore. These roles are fitting for putting an EL environment in place, and with technology, where a classroom of students will not likely be on the same level of familiarity with a training aid or tool and will also allow for deliberate practice and repetition using the tool once the introductory phase of instruction is over. It is after all the ability to arrange for situations in which the learner can practice as close to desired conditions, which will also allow for reinforcing information in the form of feedback to increase the learning experience for the learner (Gropper, 1987).

Additional responsibilities of the facilitator include considerations of the differences of training and educating in a virtual environment. The goal of which, being to create a learning environment that is going to result in the expansion of knowledge in the student, which can be difficult in virtual environments due to the various stimuli in a virtual system (Burgess, Slate, Rojas-LeBouef, & LaPrairie, 2010). The responsibility lies on the facilitator to ensure that the environment is positive, to not affect their self-efficacy with a new training aid, as well as encourage a cooperative learning environment. Particularly when using online simulations which have a large social aspect to the training intervention. Facilitators also have a responsibility of professionalism when engaging with learners in virtual environments. Teaching presence refers to the role that the facilitator has in making a meaningful learning experience for the learner in a virtual environment (McKerlich, Riis, Anderson, & Eastman, 2011).

Enhancements through Enactive Learning

Implementing technology into EL environments can provide an enhanced learning experience, provided that the selection of tools and facilitation is carried out properly. The use of simulations or other such aids that immerse the learner into a new environment and allow them to become a more active participant in the learning process can allow them to understand the learning material more thoroughly (Raymond, 2010).

Enhancing EL though, is more than just offering one simulation, or one training aid into the program of instruction. It is also about utilizing these tools together to form a future learning ecosystem that blends the tools, knowledge, experience and expertise to shape into a system in which the user becomes actively engaged. Enactive elements to the instruction can provide enhancement, because the more participatory a role that the learner plays, the more they can generate meanings from what is being presented to them as a learning narrative (Kaipainen, et al., 2011).

LESSONS LEARNED THROUGH ENACTIVE LEARNING

Experiential learning and EL are improved when technologies are used. Blending the worlds of technology and learning continue to drive at the goal of improving the ability of the learner to become self-directed and self-regulated in their learning.

Self-Regulation Improvements through Enactive Learning

The ability to self-regulate is a goal of the lifelong learner. Self-reflection provides the ability or basis for individuals to evaluate their capabilities, from a cognitive standpoint, and find areas for improvement (Phan, 2014). This ability does not come as an overnight achievement for most, however. In a learning pathway, a learner should have close-in goals as well as those that are further away (proximal and distal). The proximal goals are useful to provide rapid feedback, and felt achievement, which can increase self-efficacy and potentially increase the rate at which a learner is able to self-regulate (Hodges, 2008). These goals are shaped, often, because of prior experiences and tasks and learning that the learner feels they have mastered. The adage states that “success breeds success”, is found to be similarly accurate in that having a successful learning experience can breed or build positive self-efficacy (Hodges, 2008).

This is a foundation in the ability to utilize learning technologies as training aids and tools usefulness. Basically, if a learner is not understanding how to utilize a tool or training aid, then it will not be utilized, and the item becomes wasted. This is built from the self-efficacy of the learner. Providing use of these tools in an EL environment have more meaning, because they have provided the learner with an enactive experience which is more authentic, and can have more fidelity when utilizing technology to train to a task, and thus providing more realistic evidence to the learner that they can succeed at a given task (Hodges, 2008).

When this is done, it provides the learner more control over their learning experience, by giving them the responsibility for the decisions made in their experience, which with compounding positive experiences will increase their ability to self-regulate. Positive experiences are not the only means to drive this goal either. The use of simulations can generate learner motivation, and lead to more academic benefits in a combined EL environment than in a passive pedagogical one (Raymond, 2010) .

INTEGRATION TOWARDS ENACTIVE LEARNING

Enactive Learning on its own will have merit in the learning ecosystem of the future. However, the educational world needs to fully integrate at the point of development with the worlds of Computer Science, as well as Modeling and Simulation. Far too often, training aids are the proverbial square peg trying to be put into a round hole. That is, that they are designed, developed and attempted to be implemented into learning programs, with little to no thought for the actual transition or practical use. There are many methods and processes that are used to analyze these systems, but the gap can be bridged over what the Department of Defense (DoD) refers to as a Valley of Death, simply by collaborating at an earlier stage of the development process, instead of interjecting at a point in the acquisition process.

Computer Science

First, the simulation or learning technology must take advantage of the systems design approach. There must be a methodical way a program or software is developed. Computer Science can assist in creating a technologically advanced EL environment by providing systems that use this approach, to provide a feedback loop to the users. Whether in the form of After-Action Reviews (AAR), lessons learned, or a debrief, the point is the same. Even back to the ADDIE model. The evaluation phase in which the learner can draw out points of emphasis that can be used the next time they work to accomplish a task or attempt a learning activity is an important step.

Computer Science can continue to develop interoperable specifications or standards that can provide information about a learner, and their competencies and skills across disparate systems. This information can also carry important metadata about the learner that will be important to creating a personalized learning experience in the future.

Another area in which Computer Science can assist is in the development of networks and learning aids that provide for a seamless learning environment. This is aligned with the idea of what a future learning environment would entail. An environment in which a learner can pick up where they left off, anytime, anywhere. Think of it like watching a favorite show from a streaming service, such as Netflix, Amazon Prime Video, or Hulu. One might start watching the video on the bus ride home from work, and then transition to their Smart TV upon entering their home. This transition is seamless to the user but requires a lot of development in the underlying architecture and framework to be able to work.

In addition to the switching of devices during a learning experience, LMSs need to have the ability to allow for a seamless transition between activities, scenarios and learning situations. As attention spans grow shorter, and self-efficacy in the learner wants to remain high, learners may switch back and forth amidst learning events to allow themselves to progress forward and maintain momentum in a course.

Two important features when developing seamless learning are adaptivity and connectivity (Milrad, et al., 2013). Milrad (2013) defines *seamless adaptivity* as the technology being able to adapt to the learner without the learner being aware. *Seamless connectivity* enables the continuity of the learning experience by maintaining the learning across devices and settings, which allows learners to re-establish their learning activity.

Developing these systems is not an easy task, particularly in the ability to predict what the learning environment will be like once the product is fielded into the real world. It is key however, that these solutions are twofold. First, as mentioned, it needs to allow for the seamless transitions for the individual learner. But, second, it needs to be developed in a manner that not only allows, but encourages a social aspect of learning, to build a network or community of learning, as the academic and industrial worlds are increasingly geographically separated, and yet still reliant on collaboration (Milrad, et al., 2013). This gets back to that goal of developing a self-regulated learner. These tools must be designed to increase the learner's ability to gain knowledge and challenges the construction of knowledge from a didactic to an engaged and immersive process.

Modeling and Simulation

Modeling and Simulation (M&S), as a domain, is not as easily understood to educators, as a field, when compared to the likes of Computer Science, which has been defined for decades. However, the benefits of models and simulations to the domain of training and education is a tangible benefit that is felt by most of the training and education world, particularly as learning technologies continue to manifest themselves into programs of instruction.

Early roots of models go back in time to the earliest models of wargaming. Modern models are used in many different domains from understanding traffic patterns to modeling decision making processes. Regardless of the area that the model is intended for, the M&S community can support an EL environment by considering four factors when creating with learning in mind. These are: Overload; Transfer; Affect; and Cost (Reigeluth & Schwartz, 1989).

Overload refers to the degree to which the details of the real situation are giving too many new stimuli for the learner to be able to acquire the desired content. These training aids must take cognitive load into consideration, as well as build upon scaffolding theory to allow the learner to crawl before they run. Transfer refers to the ability to use what has been learned in the real situations. There is no greater feeling that to step into a real-world environment to perform a task and feel as though it has been done before. This is the goal of these systems- to allow training to occur in a simulated and safe environment, but ultimately to carry that over into the real-world situation. If transfer cannot occur, then the system should not be implemented. Affect is the motivational appeal of the simulation. It has already been discussed in this paper, the importance of arousal and engagement in the learning process. Lastly, Cost is always a concern with regards to how much the design, development, acquisition, delivery and ultimately operation of a system is going to be. To put this more succinctly, designers in the M&S community must take into consideration the acquisition of the content, application of the content, and finally the ability for assessment of learning to take place with the use of modeling and simulation (Reigeluth & Schwartz, 1989).

Another area which M&S researchers should focus on to enhance an EL environment is to consider the approaches to goals of the learner. Whether working to accomplish a new task, obtain a new learning outcome, or achieve a level of self-regulation. Providing tools which allow the learner to achieve mastery and the ability to assess performance along the way (Phan, 2014). These tools which can allow for the analysis can afford to be extended to capture more data and information which will deepen the enactive aspects of simulations by providing a richer experience driven by data (Wilensky & Stroup, 1999). The ability to have experiences driven by data will also allow the learner to become more participatory in their learning pathway, and then be able to expand that into a learning network with others. M&S professionals should take this into account in their design and development.

Changes in ISD

Personalized learning is coming closer to fruition with advances in technology. These advances are in place in many forms already and continue to be polished and become better in their fidelity. This is seen quite often in mobile technologies, whether in learning tools or social applications. The development of these tools allows for the progression of learning to move out of the classroom and into the personal space and timeline that the learner desires (Milrad, et al., 2013).

This must begin with a shift in culture about the structure and epistemologies, according to Milrad (2013). First, as mentioned prior, a difference in understanding of where knowledge is derived, and where the burden of responsibility is placed on gathering that knowledge. No longer will it be placed solely on the shoulders of a teacher with subject matter expertise, but instead building to a collaborative social learning environment. IDs must work to design curricula and programs that will allow for this flexibility, and the ability to rely on more than one theory of learning. Further, the learner must be given this responsibility of learning as well. The learner must take a more active role in their learning. Additionally, they must be able to make their own meaning from the learning that is taking place, which means that in some cases, the learning goals/objectives have flexibility and are not rigidly defined (Ertmer & Newby, 1993). This shifts the facilitator to that role of demonstrating to students how to make meaning, giving them strategies for success and allowing them to build this knowledge through collaboration, and through multiple perspectives (Cunningham, 1991).

Considerations by IDs should be given to the complexities of teaching simulations, virtual environments, and even computer driven training aids. Self-efficacy has been discussed prior, but in reference to the use of tools, if the learner feels that they do not have the capability to use the tool, then it is another learning opportunity wasted. A primary concern with learning technologies, such as VR or Augmented Reality (AR) or Mixed Reality (MR) is the availability of these tools. If there is a limited amount of resources, students will have limited use of them, and will not gain the same experience, because the focus will likely be on the "how" of using the tool, versus the content that the tool was intended to deliver (Herbelin & Ciger, 2008). Instead, timing considerations should be given to maximize the time that the training aid is used and have specific purpose and intent behind its use in the program of instruction. Often unspoken as well is the ability and knowledge of the facilitator to utilize the tool, so consideration must be given to the likelihood that the facilitator can deliver instruction through the training aid in question.

IDs and facilitators will also need to consider the design of the learning space. With the learning technologies of the future, this is not restricted to the classroom. It includes the virtual space. It includes the User Experience (UX) of the online environment, whether a repository, web course, chatrooms, or other collaborative areas. If a physical classroom, this regards the specific set up of the space, and is it conducive for the training aids that are intended to be used? Considerations of facilitators and IDs should be to encourage participation of all learners, as well as ensure that the facilitator is able to facilitate in the virtual environment. Both IDs and facilitators should recognize that the creation, design, and implementation of these virtual spaces takes considerable time, and should be planned for. Finally, when creating an online learning environment, consideration should be given to the amount of information that is presented to the learners, and their ability to work through it in a given time (Burgess, Slate, Rojas-LeBouef, & LaPrairie, 2010).

Lastly, a new paradigm or structure should be utilized when implementing learning technologies. Gupta (2009) outlines some Enactive Learning Dimensions that could be used to implement enhanced EL (Figure 1).

Enactive Learning Dimensions
Production Pattern: The lag between demonstration of an action and practice by the learner.
Structuredness of Practice: The extent to which technology imposes its procedures on the learner
Restrictiveness of practice: The degree to which a system limits an action.
Feedback: The degree to which a system provides a response, including correction, addition or approval and speed of response.
Guidance: The degree to which a system provides direction or advice towards a course of action.

Figure 1. Enactive Learning Dimensions (Gupta & Bostrom, 2009)

CONCLUSION

There are naysayers and opponents of learning as a science that would claim that there is nothing new under the sun, and therefore no new approach by which to obtain learning. The Old Guard would claim that the way they learned was good enough to get them where they ended up and thus should be good enough for the upcoming generations. Those in the know, and those understanding of the complexities of the social environment blended with technological advances understand that a change is needed. Learners have an immediacy effect when it comes to knowledge, which is fostered by the ability to utilize web-based search engines that is only limited by the imagination and an internet connection. No longer are learners in a mode that is dependent on a passive learning environment where information is received from a sole source. In order to achieve an EL environment, educators and trainers must continue to collaborate and partner with Computer Science and M&S professionals in order to provide the learner with the right learning technology for a specific learning outcome. Implementing of these learning technologies must be done with a purposeful intent, and not just because there was funding in a budget to make a flashy purchase. Future research should focus on furthering the connections between this communities and develop a standard which IDs may implement in the design for the implementation of learning in an EL environment. Empowering the learner is a means to make them a stakeholder in their own learning and requires a shift in the role of the facilitator. By collaborating with each other, and integrating the right technology tools, learning can be improved, learning can be more efficient, and learning can truly become a lifelong evolution.

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