Virtual Learning Environments in Primary Schools–Using Learning Theory to Develop an Interactive Virtual Medium

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Abstract: Virtual Learning Environments (VLEs) bring traditional educational strategies into the 21st century by using technology as a deployment method. Online environments can be utilized alone or in conjunction with face-to-face instruction to develop a robust educational paradigm that is tailored to the students' needs. This paper intends to describe how learning theories recently applied in traditional classrooms can be transferred to an interactive virtual medium to achieve this paradigm. In addition, this paper also demonstrates how the practical model of Piaget's Constructivist Theory of Learning and Vygotsky's Zone of Proximal Development, and their related strategies, could be applied to achieve a set of specific and effective e-learning objectives. This paper will also discuss identify how these strategies can be used to develop a VLE appropriate for primary schools.

Keywords: E-learning, Piaget's constructivist theory, Virtual Learning Environments, Zone of Proximal Development.

Introduction

With the available e-learning tools in hand and their perceived deficiencies on record, we will attempt to design a new primary school VLE e-learning model that takes into account the principles of constructivist theory in conjunction with Vygotsky's theory [7] of the Zone of Proximal Development. We will also try to assess and evaluate how we can create effective VLEs to integrate seamless pedagogical values into the e-learning system.
Effectively speaking, the launching of VLEs in both primary and secondary schools could be extremely effective and have tremendous positive results [2], in its monumental report in the effectiveness of VLEs, suggests that:

"To set up an efficient VLE to implement school curriculum, the school management may need to think of its effectiveness that in turn is influenced by three important factors: knowledge management, pupils' approach to learning, and academic performance (p32)."

In other words, any VLEs used in a primary school should satisfy the above-mentioned pedagogical parameters in a way that eventually leads to success of the e-learning initiative. An effective VLE design should provide seamless knowledge and skill management. Before designing a prototype model, we need to look at various factors that influence the e-learning outcome. The VLE prototype should meet the following criteria:

1. It should consider various issues that relate to learners' mental development stages, cognitive development and user preferences.
2. It should be flexible, easy to use and have an effective interface.
3. It should address the concerns of instructors cited previously in this paper. Using effective VLEs to integrate seamless pedagogical values

1. Pedagogical Framework to the Proposed Model

Swiss developmental psychologist Jean Piaget dedicated his life to studying child development and is credited with the development of the constructivist theory of knowing. His theory acknowledges that people bring previous knowledge to each knew encounter, and as they take in new information it is assimilated with that previous knowledge in a continuous process to gain a higher level of understanding.

Constructivism (also commonly known as social constructivism) recognizes that each student brings a unique and diverse perspective to the learning environment. This is especially beneficial in a VLE since there are no physical boundaries as to where the learners may be; instead of a traditional classroom where the students may all share a culture or socioeconomic background, virtual learners might be scattered across the globe.

Piaget's constructivist theory links up well with another prominent learning theory, the Zone of Proximal Development (ZPD), which was developed by Lev Vygotsky in the early 20th century. ZPD promotes the idea that primary-age children learn first and best through social interactions, with the teacher serving as observer. The ZPD theory is based on the concept that learners are motivated to reach slightly outside their comfort zone to further develop their knowledge and skills. The concepts of constructivism and ZPD form the pedagogical framework to our proposed VLE model for primary school students.

2. Description and salient features of the new e-learning model

Incorporating both constructivism and ZPD into our e-learning prototype for primary school students, we have established the following methodology for learning interactions:

1. Socialization
2. Individual Pre-assessment
3. Active Learning
4. Individual Post-assessment

This methodology is intended to be circular, with the experience of knowledge transfer a cyclical process. In other words, the learning experience does not end. It is built upon by repeating the process to continually increase knowledge. Let's take a look at each step of the process and how it can be applied to the primary school VLE.

Both Piaget and Vygotsky understood the critical role that socialization plays in the learning process, and that is why this prototype includes socialization as its initial step. Using a simple chat-like interface that will likely be familiar to most primary school students, each learner should be encouraged to share information: a personal detail, such as their favorite color; an interesting experience, such as a recent vacation; or any other information that the student wants to share with his or her peers. Not only does this provide the basis for peer-to-peer relationships, it also provides the foundation for learning in a constructivist methodology. Students take in information from their peers and assimilate it with their own knowledge and experiences. For example, when Sarah shares that her family took a vacation to Disney World in Florida and also visited the ocean, the other learners may assimilate that Florida is near an ocean.

At this point, the VLE shifts into a pre-assessment, designed to evaluate the existing level of development on the topic at hand. For example, if the lesson is covering colors, the VLE may provide a technology-based quiz that assesses the student's knowledge of various colors. Keeping in mind that some primary students may not yet be able to read, the VLE should incorporate audio as well as visual effects to meet each learner's needs. The pre-assessment provides a baseline for the instructor before moving into the active learning

phase of the methodology. The baseline identifies each student's existing zone of knowledge, which is necessary to understand the ZPD--that area that is just slightly outside the existing zone. If a student is pushed to make too large a leap between the existing zone of knowledge and the next zone, they are likely to back away from the learning process altogether. The pre-assessment encourages the effective building of skills.

With the information gained in the pre-assessment, teachers can adapt an active learning environment to each student's needs. Continuing with the color example, if a teacher determines that most of the students can identify primary colors but have difficulty identifying secondary and tertiary colors, the teacher can tailor the learning experience to meet those needs. Likewise, if a pre-assessment identifies a student who needs remedial or more challenging work, the instructor can accommodate those needs. The teacher can also group learners based on level of ability to encourage peer-to-peer socialization and learning, and to make sure the student continues to build on existing knowledge.

This building process has come to be known in recent years as "scaffolding." This term was developed in the 1950s by cognitive psychologist Jerome Bruner, and it originally related to the development of language skills in young children. However, it has grown to include all cognitive development based on a model of helpful interactions between an adult and a child that build the child's skills. The adult provides boundaries and perhaps even a template for the learning experience. As it relates to our methodology, scaffolding takes place in the third stage as the instructor provides an active learning experience.

Instructors may have to use some creativity when designing active learning experiences delivered in a VLE. In his constructivist learning theory, Piaget noted three types of learning in children: functional play, symbolic play, and games with rules. Traditional classrooms allow for physical functional play, such as running or jumping up and down, and symbolic play, such as making paper dolls. In the VLE, however, instructors may have to be creative when developing play-based learning experiences that lack the physical component. For example, instructors can encourage role-playing as a type of symbolic play that can be accomplished in a VLE.

The key to the active learning step is to continue to provide the socialization that is so critical in both Piaget's and Vygotsky's methodologies. It is important to note that "active" learning refers to active cognition, rather than active physical behavior. A student can be physically calm sitting in a chair in front of a computer and still be engaged in active learning. The critical piece of active learning is that the student is engaged in the learning process rather than passively receiving facts and information.

Following the active learning step in our methodology, the student returns to a brief individual post-assessment to evaluate the effectiveness of the learning experience. This stage should parallel, although not exactly mirror, the pre-assessment, to fairly evaluate what was learned. Integrating the individual stages of this methodology, the pre- and post-assessment, with the more socially interactive stages provides a balance to the learning experience and gives the student time to reflect on what has happened and what will happen next. With this VLE model, the primary advantages include the following:

1. It is a user-centric model. According to Anghern [1], the learner should be at the center of the e-learning model and this approach becomes very critical for managing individual knowledge capital and competence.
2. It is extremely interactive. The model proposed here is very dynamic and interactive. The instructor is continuously available to the student and the peers are in ready contact as well. Primary school learners need constant monitoring and this model helps the instructor mentor the young learners on a consistent basis.
3. The scaffolding effect allows the learners to use a rich learning environment to try out exploration, manipulation and construction of new ideas and learning fundamentals

Table 1: Constructivism Learning Model in a VLE

Stage	Description	Example
Socialization	Teacher gives a topic; students share by typing their responses in the chat area of the VLE.	"Today we're going to talk about USA, Who wants to share something about a state they've been to, other than the one we live in?"
Individual Pre-assessment	Online assessment of ability	Each student individually sees a map of the U.S. & a state name, the student should click on the state outline that matches the state name.
Active Learning	During the lesson, the teacher, using the VLE, gives the lesson. Each student must participate by responding to questions & Interacting in the VLE.	As the teacher talks about a state, it lights up on the screen and icons appear to illustrate the discussion. For example, as the teacher discusses Iowa's farming & biofuel industries, an icon of corn appears.
Individual Post-assessment	Online assessment of learning	Each student sees the same map as seen in the pre-assessment, but now must match icons to the states they represent.

3. Conclusion

E-learning is a far-reaching pedagogical transformation for a traditionally inclined curriculum. Digital inequality and inequitable access to online curriculum could pose a great challenge when designing a new VLE model. An easy-to-use and flexible e-learning tool could act as a strong foundation for effective distribution of school curriculum.

Many authors and academicians believe that VLEs in a primary school setting are out of context and not useful. Many schools, both in developed and developing countries, are finding deployment of VLEs very challenging. One of the biggest concerns that most of these schools have is whether the e-learning tools used are transforming the pedagogical values of teaching in an adverse manner.

Of late, there is an intense debate on the efficacy of commercial e-learning tools in primary classroom teaching. One of the concerns expressed by [4] is that the learning-management system vendors are trying to maneuver their tools as the focal point for e-learning in organizations, eventually to remove control from the tools' end-users; here, the school management, instructors and learners. Merrienboer et al [6] believes that:
"It is not the media, but the instructional methods and the delivery systems that can enhance the overall quality of education and learning experience."

Most of the VLE systems are excellent at delivering course materials. However, this cannot be the sole criteria for the success of e-learning. In his article on Learning Management Systems - The wrong place to start learning, Siemens [4] opines that:

"A good learning tool will help enhance informal learning, support superior performance and manage skills and knowledge development. In fact, as an e-learning tool becomes more sophisticated and feature-rich, it tends to lose its practical utility and basic functionality."

Significant progress has been made in designing and engineering aspects of many e-learning platforms, tools and models. Although feature-rich and good in delivery, they may lack from inherent deficiencies and user-side weaknesses. In addition, such tools have

been working with a common principle as noted by Siemens [4] – tool selection first and instructor requirements second. Simplified, it means that the tool itself tends to override the user and user's preferences or options.

Gagne's theory of learning espouses the ideas of signal learning, stimulus-response learning and verbal association [9]. Although, Novak and Taylor's Stimulus-Response Theory (1977) forms the basis of Gagne's theory, the latter includes a number of cognitive factors in the learning model that eventually leads to an all-around development of young learners' mental and brain development.

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