

# Rethinking Education in the Age of Technology: The Marriage of Skills and Technology in Curriculum Process

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**Abstract**—The tremendous upheaval changes of information and communication technologies have a great impact on educational world. Thus, learning in the 21<sup>st</sup> century has so much different than previous years. The revolution of technology in this digital era has brought changes in the educational world with introducing a brand new learning environment which is called as Frog Virtual Learning Environment (Frog VLE) in Malaysian schools. Besides, the importance on the integration of the 21<sup>st</sup> Century Skills among students becomes a watchword in today's world. A new learning strategy on how to best learn in this 21<sup>st</sup> century by taking into account technology usage in a Virtual Learning Environment (VLE) and 21<sup>st</sup> Century Skills acculturation become an important step to be implemented. This paper will explore in-depth how to best prepare learning strategy that will involve technology usage in teaching and learning process in order to enhance 21<sup>st</sup> century skills as well as achieving desired learning outcomes by amalgamating Dale's Cone of Experience and Bloom's Taxonomy along with the framework of 21<sup>st</sup> Century Skills as presented by Partnership for 21<sup>st</sup> Century Skills. Hence, this paper provided a brand new framework on how to best learn in this 21<sup>st</sup> century by using technology as the main catalyst in today's classroom by introducing a new framework of learning strategy which is called as Framework for 21<sup>st</sup> Century Skills Acculturation (FF21A Model) to be applied in today's educational world. The FF21A model carefully and clearly explain how the process of teaching and learning in this 21<sup>st</sup> century should be carried out effectively by implementing the Web 2.0 technology along with teaching and learning activities in order to achieve the desired learning outcomes.

**Keywords**—Dale's cone of experiences, Bloom's taxonomy, technology, 21<sup>st</sup> century skills.

## I. INTRODUCTION

THE tremendous changes in information and communication technologies have a great impact on various sectors around the world. Educational world seems to have enormous pressure in adapting this digital age in order to produce graduates who are not only successful in their education, but also in their life, career and work. This is because learning in the 21<sup>st</sup> century is so much different than learning in previous years.

Consciously or not, educators today know that digital technology is becoming an important part of students' education (Glancy & Isenberg, 2011; Gill & Dalgarno, 2008). Today's educators are preparing their students not only for the life immediately after they graduate, but also for the future in which, within the students' working lifetimes, technology will become over one trillion times more powerful (Prensky, 2010). As technologies continue to change and newer technologies emerge, the characteristics and properties of the educational world in fulfilling the workforce demand also change. The

“21<sup>st</sup> Century Skills” has become the watchword in the educational world, and this causes educators to be more concerned about the implementation of the 21<sup>st</sup> Century Skills

along with the use of technology in teaching and learning process. As a result, the educational world has become more challenging day by day (Partnership for 21<sup>st</sup> Century Skills (P21), 2007; Pandian, 2005; Dakich, 2005; Kementerian Pelajaran Malaysia (KPM), 2010). The implementation of the 21<sup>st</sup> Century Skills need to progress along with the current technology because both elements are important aspects of today's digital era. This is because the use of technology will enable students to gain knowledge on the 21<sup>st</sup> Century Skills such as solving complex tasks, make quick decisions, and critical thinking which are the skills needed in the 21<sup>st</sup> century (Prensky, 2006; Sanders & Morrison-Shetlar, 2000; Jones & Fitzgibbon, 2006). With the awareness of the changes caused by this digital era, for the sake of future education, a proper planning on learning strategy to fulfill this century's requirements needs to be formed wisely.

Nevertheless, how to best prepare a better learning strategy to meet this 21<sup>st</sup> century's requirement is yet to be answered. A deeper understanding of learning environment in this century needs to be mastered by those who are interested to do research in this area. The engagement of learning environment which is enriched by technology usage, the adoption of learning theories, and the connection with human brain in the learning process are the main aspects need to be considered in designing a proper learning strategy. Engaging technology and students is important. This is because the increased engagement, in turn, typically produces better retention of material and higher test scores (Prensky, 2010). Hence, this paper presents a new framework and deeper discussion on the combination of two theoretical frames which are expected to have its own connectedness and how will these frameworks matches in this 21<sup>st</sup> century learning and fit into supporting 21<sup>st</sup> century learners, technology training, and 21<sup>st</sup> century skills acculturation.

## II. THE BLOOM'S TAXONOMY, DALE'S CONE OF EXPERIENCE AND 21<sup>ST</sup> CENTURY SKILLS THROUGH VIRTUAL LEARNING ENVIRONMENT

### A. Bloom's Taxonomy

Bloom's Taxonomy of Educational Objectives in the Cognitive Domain is an attempt to identify the cognitive level of a learner and provide a common vocabulary for educators to discuss their students' abilities as well as the educator's own personal goals for the student. From the basic knowledge of the subject, this taxonomy progresses toward more complex or higher levels of critical thought, culminating with sophisticated thinking processes by using the concepts under study. The structure of Bloom's Taxonomy is hierarchical in nature and provides six levels of learning; Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. Deeper knowledge is hopefully achieved as one move to the higher levels (e.g. analysis, synthesis and evaluation). The higher levels often involve active learning participation (Rahn & Moraga, 2007). Bloom's theory has been widely used in today's education. In this theory, Bloom identified a relationship between levels of learner effort and

levels of learning achievement. Specifically, he associated high levels of learner effort with the achievement of high-level or more complex learning objectives (Bloom *et al.*, 1956). Previously, the cognitive domain is divided into six levels as shown in Figure 1. However, in the 1990's, a former student of Bloom, Lorin Anderson with David Krathwohl, revised Bloom's Taxonomy and published Bloom's Revised Taxonomy in 2001. The terms of knowledge, comprehension, application, analysis, synthesis and evaluation have been changed to remembering, understanding, applying, analyzing, evaluating and creating.

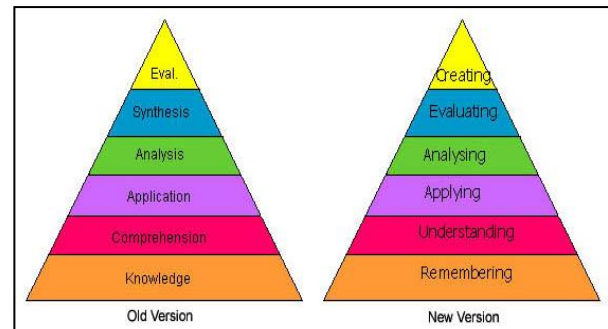


Fig. 1: Bloom *et al.* (1956) vs. Anderson & Krathwohl (2001)

### B. Dale's Cone of Experience

Dale's Cone of Experiences is a model that incorporates several theories related to instructional designs and learning process. Dale (1969) stated that the students acquire more knowledge through what they "do" compared with what they "heard", "read" or "observed". His research led to the development of the Cone of Experience. Today, this "learning by doing" has become known as "experiential learning" or "action learning". Figure 2 shows the cone of experience. Edgar Dale's "Cone of Experience" (1969) organizes learning experiences according to the degree of concreteness. According to Dale's research, the least effective method at the top, involves learning from information presented through verbal symbols, i.e., listening to spoken words. The most effective methods at the bottom, involves direct, purposeful learning experiences, such as hands-on or field experiences. Direct purposeful experiences represent reality or the closest things to real, everyday life.

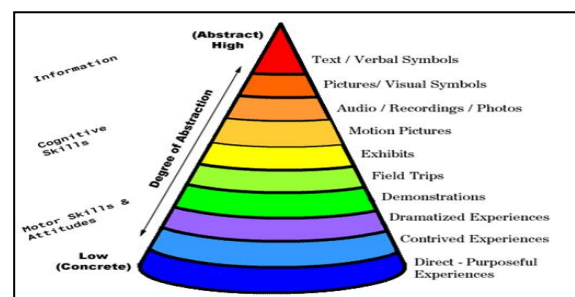


Fig. 2: The cone of experience (Edgar Dale, 1969)

### C. 21<sup>st</sup> Century Skills

Our society is developing towards a knowledge society because of the ubiquitous presence of technology in this era. Anderson (2008) stated that the impact of technology in our society has caused many jobs for routine production workers - those who perform repetitive tasks – such as assembly line workers, to disappear because of the increasing potential of technology to take over recurring tasks. However, according to Levy and Mundane (2004), for tasks that are rule-based, computers are an easy substitute, but computers cannot easily replace humans in tasks that require the interpretation of complex patterns. These more complex tasks can be found in many jobs – for example, a truck driver that has to find his way to deliver goods and a physician diagnosing a patient. In both tasks, humans cannot be replaced by computers, but they can be supported by computer-based information at low cost. Not the exchange on information as such has become important, but a *particular understanding* of information has become an important part of many jobs (Levy & Mundane, 2006). Because of this reason, new competencies called 21<sup>st</sup> Century Skills have emerged in order to fulfill the skills needed in this century.

Partnership for 21<sup>st</sup> Century Skills (2009) has developed a unified, collective vision for learning known as Framework for 21<sup>st</sup> Century Learning. This Framework describes the skills, knowledge and expertise students need to master to succeed in work and life. It is a blend of content knowledge, specific skills, expertise and literacy. This Framework is to help practitioners integrate skills into the teaching of core academic subjects. Each of 21<sup>st</sup> Century Skills implementation requires the development of core academic subject's knowledge and understanding among students. According to Ledward & Hirata (2011), the P21 is a national organization that advocates for the 21<sup>st</sup> century readiness of every student. P21 defines 21<sup>st</sup> Century Skills as a blend of content knowledge, specific skills, expertise, and literacies necessary to succeed in work and life.

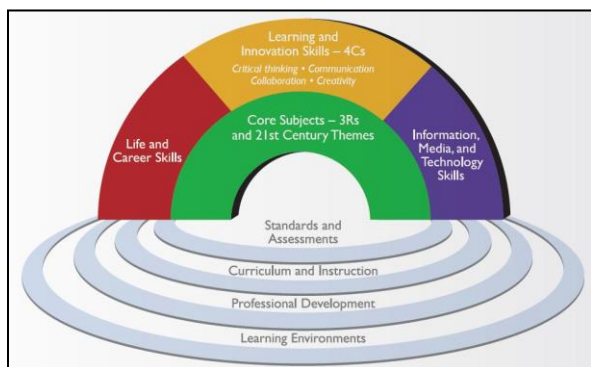


Fig. 3: 21<sup>st</sup> century students' outcome and support systems (P21, 2009)

Within the context of core knowledge instruction, students must also learn the essential skills in order to success in today's world, such as critical thinking, problem solving, communication and collaboration. When a school or district builds on this foundation, combining the entire Framework with the necessary support systems such as standards,

assessments, curriculum and instruction, professional development and learning environments, students are more engaged in the learning process and graduate better prepared to thrive in today's global economy. Figure 3 shows the framework suggested by P21.

### III. AMALGAMATION OF BLOOM, DALE AND 21<sup>ST</sup> CENTURY SKILLS THROUGH VIRTUAL LEARNING ENVIRONMENT

The output from all the discussions, explanations and in-depth research on the interrelationships between Dale's Cone of Experience and Bloom's taxonomy is a framework called Framework for 21<sup>st</sup> Century Skills Acculturation (FF21A). The connection between Dale's Cone of Experience and Bloom's taxonomy was explored in designing an appropriate learning strategy to fit in the 21<sup>st</sup> century learning environment especially in Virtual Learning Environment (VLE). The design also took into account the implementation of 21<sup>st</sup> century skills.

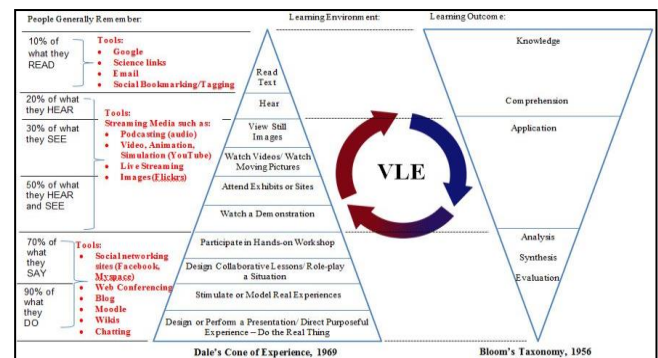


Fig. 4: Framework for 21<sup>st</sup> Century Skills Acculturation (FF21A Model)

In the real world of education, learning objectives and learning outcomes are the crucial part of teaching. The success of a teacher in his or her teaching and learning process can be seen on his or her students' achievement in answering questions during examination or test. Effective teaching and learning process promise desired learning outcomes. Teachers use Bloom's taxonomy to initially plan their curriculum objectives. It aims to ensure that students achieve the desired learning objectives effectively (Bloom *et al.*, 1956). However, how learning should be conducted still depends on teachers themselves. The options are vast, but educators should make the right choice to ensure it can help to boost students' learning. As you can see from Figure 4, Pastore (2003) have disclosed the percentage of the retention of knowledge gained by students by using alternatives suggested in Dale's Cone of Experience. The result can be seen in Figure 4. It was proven that various tools can cause different retention of knowledge gained by students during their learning process (Dale, 1969). Because of the awareness of the effect of using technologies in teaching and learning process, and in order to align suggested

tools in Dale's Cone of Experience in this digital age learning environment, researcher has listed out the appropriate Web 2.0 technologies that match with the alternatives given in Dale's Cone of Experience to expose readers to various alternatives in conducting and performing their teaching and learning process and stay connected with their students, teachers and peers by using interesting approach. Dale (1969) strongly suggests engagement through participation in interactive materials is more likely to result in student engagement, thus understanding.

Even though we are aware that interactive materials affect students' learning process, we still cannot simply judge the cognitive level of a student. Students' cognitive level can only be specified by using Bloom's taxonomy. That is why Bloom's taxonomy was placed in this framework. Teachers have the responsibility to guide students to achieve higher levels of cognitive thinking or known as Higher Order Thinking Skills (HOTS) during their learning process as it was one of the crucial skills that needed to be implemented among them in this century (New Straits Times, 2012a, 2012b; MOE, 2011). Figure 4 show that the Bloom's taxonomy was built inverted from the real one because of its own reason. For example, let us compare two different situations here, a teacher uses reading method and a teacher uses experiment method during teaching and learning process. For the first situation, a teacher prefers to use reading (read text in Dale's Cone of Experience) during their teaching and learning process. Wiman & Meierhenry (1969) stated that reading activity will produce learning outcomes that ask students to describe, explain, define and list. If you align these learning outcomes with Bloom's taxonomy, you can find out that these learning outcomes refer to the level of cognitive which are knowledge and comprehension. But we cannot simply say that reading will only help our students to achieve knowledge and comprehension level in Bloom's taxonomy. Then, what about the students who have vision disability but are able to succeed at the university level? This shows that there is no doubt that students can still achieve higher cognitive level from knowledge to evaluation even when they only use reading as the main activity during their learning process.

For the second situation, a teacher prefers to use experiment (do the real thing in Dale's Cone of Experience) during their teaching and learning process. Students in this situation can achieve higher cognitive level in Bloom's taxonomy faster compared to students who are in reading activity. Wiman & Meierhenry (1969) stated that students in this activity able to achieve learning outcomes such as analyze, design, create and evaluate. Same goes here, if you align these learning outcomes with Bloom's taxonomy, you can find out that these learning outcomes refer to the levels of cognitive which are analysis, synthesis and evaluation. Dale (1969) stated that, "do the real things" experiences were closer to the real world experiences rather than reading text, thus for some students, "do the real things" experiences were better learning experiences than reading from a book. "Do the real things" is about engaging

students with the content of learning and mental process. This activity involves several senses. This showed that all of our senses contribute towards the total input which we receive. The more we try to use our senses, the more we got engage with content and our mental process. When the engagement of mental activity is getting higher, we tend to retain more knowledge from our learning process and learn faster than when we use reading method.

The differences between both situations are how fast can a student travel from the lowest part in Bloom's taxonomy which is knowledge to the highest level which is evaluation? They can still achieve higher level in Bloom's taxonomy by using one of the activities mentioned above, but, how fast? At this point, the mental ability and time play a salient role in order for a person to achieve higher cognitive level as stated in Bloom's taxonomy. As teachers, we need to always keep in mind that different students have different mental ability in processing the knowledge given, and there is a possibility that some pupils will work and learn less effectively than others in the class (Berk, 2009; Pritchard, 2009). Besides, the engagement of the human brain and the learning process will take time. The inculcation of knowledge will take time as it depends on students' mental ability (Pritchard, 2009). Besides, learning experiences must make sense in order to allow new information to settle into existing brain patterns of knowledge (Bos, 1997). The question is whether the methods used by teachers such as using Web 2.0 technologies as embedded in FROG VLE which is closer to the students' real world and by involving greater engagement in mental activity will help students reach faster to the top level in Bloom's taxonomy is yet to be answered.

The 21<sup>st</sup> Century Skills is a set of skills that needed to be implemented among students in this century. These skills are in fact have already been located within this VLE-based learning environment. I started to realize this fact after in depth reading on the meaning and explanation of 21<sup>st</sup> Century Skills. This is because through the use of technology, students able to gain knowledge in 21<sup>st</sup> Century Skills such as solving complex tasks, make quick decisions, and critical thinking which are skills needed in the 21<sup>st</sup> century (Prensky, 2006; Sanders & Morrison-Shetlar, 2000; Jones & Fitzgibbon, 2006). That is why the implementation of 21<sup>st</sup> Century Skills needs to move along with the current technology, because they both shared a phenomenal bonding. But it is important to keep in mind that the purpose of using technologies in classroom is to help us to achieve desired learning outcomes during teaching and learning process. Therefore, the connection between Dale's Cone of Experience and Bloom's taxonomy becomes an important aspect in today's educational world. Results gathered from previous research by Mohamad Mohsin, Hassan, & Ariff (2014) strengthen the effectiveness of the amalgamation of Bloom, Dale and 21<sup>st</sup> century skills through VLE. This research finally comes out with a new framework of Virtual Learning Environment (VLE) with emphasis on the amalgamation of the framework of Dale's

## Cone of Experience and Bloom's Taxonomy along with the Partnership for 21<sup>st</sup> Century Skills.

### IV. CONCLUSION

As a result, through the data collected and in depth reviews, it shows that the mapping on Bloom and Dale in the VLE able to improve students' 21<sup>st</sup> century skills and students still can achieve desired learning outcomes as required by teachers. Besides, the findings of this study demonstrated positive uses and results of knowledge on strategy in using VLE for 21<sup>st</sup> Century Skills acculturation through teaching and learning process. In designing a culture of learning based on VLE to harness the 21<sup>st</sup> Century Skills through teaching and learning process, this study takes into account various important aspects such as a paradigm shift on pedagogical aspect from behaviorism to social learning in order to fit in the acculturation of 21<sup>st</sup> Century Skills through VLE; the transition of knowledge from abstract to concrete in order to make sure students will achieve desired learning outcomes in using VLE for 21<sup>st</sup> Century Skills acculturation; teachers' role in teaching and learning which is more as a facilitator in guiding students in their learning process; students' role which allowed students to become more learner centered, self-directed and responsible on their learning; and cooperative and collaborative learning that gives students the opportunity to experience their own learning process through group activities and presentations on topics given. Hence, FF21A can be said to be effective and able to fit into this 21<sup>st</sup> century. It is hoped that the formation of this FF21A model will be a starting point for future research.

### REFERENCES

- [1] Anderson, R. E. (2008). Implications of the Information and Knowledge Society for Education. International Handbook of Information Technology in Primary and Secondary Education. *International Handbook of Information Technology in Primary and Secondary Education*, 20 (2008), pp. 5-22.
- [2] Anderson, L. W., & Krathwohl, D. R. (2001). *A Taxonomy for Learning Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. New York: Addison Wesley Longman.
- [3] Berk, R. A. (2009). Multimedia Teaching with Video Clips: TV, Movies, YouTube, and mtvU in the College Classroom. *International Journal of Technology in Teaching and Learning*, 5(1), pp. 1-21.
- [4] Bloom, B. S., Englehard, M. D., & Furst, E. J. (1956). *Taxonomy of Educational Objectives. Handbook I: The cognitive domain*. New York: Longman.
- [5] Bos, S. (1997). *The Brain: Implications for Teaching and Learning*. Community Works Press: Brattleboro, Vermont.
- [6] Dale, E. (1969). *Audiovisual Methods in Teaching, Third Edition*. New York: The Dryden Press; Holt, Rinehart and Winston.
- [7] Dakich, E. (2005). *Teachers' ICT Literacy in the Contemporary Primary Classroom: Transposing the Discourse*. Retrieved on May 29, 2012, from <http://www.aare.edu.au/05pap/dak05775.pdf>.
- [8] Glancy, F. H., & Isenberg, S. K. (2011). *A Conceptual E-Learning Framework*. International Society for Technology in Education (ISTE). (2007). *Web 2.0: New Tools, New School*. Retrieved on May 24, 2012, from <http://www.iste.org/images/excerpts/NEWT00-excerpt.pdf>.
- [9] Gill, L., & Dalgarno, B. (2008). Influences on Pre-service Teachers' Preparedness to use ICTs in the Classroom. In Hello! Where are you in the landscape of educational technology?. *Proc. Ascilite Melbourne 2008*. Retrieved on July 16, 2011, from <http://www.ascilite.org.au/conferences/melbourne08/procs/gill.pdf>.
- [10] Jones, N., & Fitzgibbon, K. (2006). For Better or Worse? The Marriage of Key Skills Development and on-line Learning. *Journal of Vocational Education & Training*, 54(3), pp. 395-412.
- [11] Ministry of Education (MOE). (2011). *Projek Perkhidmatan IBestariNet: Taklimat kepada Jabatan Pelajaran Negeri*. Retrieved on April 10, 2012, from <http://www.slideshare.net/fauziyunus/1-bestarinet>.
- [12] Mohamad Mohsin, S. F. A., Hassan, R., & Ariff, M. F. (2014). *Nurturing 21<sup>st</sup> Century Skills through 21<sup>st</sup> Century Learning Environment*. Proceeding of International Seminar on Technical and Vocational Education 2014 (TVEIS 2014). Pp 311-322.
- [13] Kementerian Pelajaran Malaysia (KPM). (2010). *Jiwa Dan Minda Bersatu ke Arah Pembastarian Sekolah*. Kuala Lumpur: Bahagian Teknologi Pendidikan, Kementerian Pelajaran Malaysia.
- [14] Levy, F., & Murnane, R. (2004). *The New Division of Labor: How Computers are Creating the Next Job Market*. Retrieved on July 4, 2014, from <http://press.princeton.edu/chapters/s7704.html>.
- [15] Levy, F., & Murnane, R. (2006). *How Computerized Work and Globalization Shape Human Skill Demands*. Retrieved on July 17, from [http://kms1.isn.ethz.ch/serviceengine/Files/ISN/29255/ipublicationdocument\\_singledocument/251462a2-e5cc-4e6a-838c-467b0d834e09/en/2005-006.pdf](http://kms1.isn.ethz.ch/serviceengine/Files/ISN/29255/ipublicationdocument_singledocument/251462a2-e5cc-4e6a-838c-467b0d834e09/en/2005-006.pdf).
- [16] Ledward, B. C., and D. Hirata. 2011. *An overview of 21<sup>st</sup> Century Skills*. Summary of 21<sup>st</sup> Century Skills for Students and Teachers, by Pacific Policy Research Center. Honolulu: Kamehameha Schools-Research & Evaluation.
- [17] New Straits Times. (2012a, July 21). *Time to Put On HOT Cap to Motivate Students*. Retrieved on May 10, 2011, from <http://www.moe.gov.my/bppdp/keratan/21712NST.pdf>.
- [18] New Straits Times. (2012b, July 21). *Learning to use 'School Times' to Spice Up Classes*. Retrieved on May 10, 2011, from <http://www.moe.gov.my/bppdp/keratan/21712NST.pdf>.
- [19] Pandian, A. (2005). *Literasi Teknologi Maklumat dikalangan Guru Pelatih Bahasa*. Pulau Pinang, Malaysia: Universiti Sains Malaysia.
- [20] Partnership for 21<sup>st</sup> Century Skills, P21. (2009). *Q & A on 21<sup>st</sup> Century Skills*. Retrieved on August 9, 2012, from <http://21stcenturyskillsbook.com/blog/q-a/>.
- [21] Partnership for 21<sup>st</sup> Century Skills, P21. (2007). *Framework for 21<sup>st</sup> Century Learning*. Retrieved on August 19, 2011, from <http://www.p21.org/about-us>.
- [22] Pastore, R. S. (2003). *Principles of Teaching*. Retrieved on May 17, 2012, from <http://teacherworld.com/potdale.html>.
- [23] Prensky, M. (2006). *"Do't Bother Me Mom- I'm Learning"*. St. Paul, Minnesota: Paragon House.
- [24] Prensky, M. (2010). *Teaching Digital Natives: Partnering for Real Learning*. United Kingdom: Corwin.
- [25] Pritchard, A. (2009). *Ways of Learning: Learning Theories and Learning Styles in the Classroom, Second Edition*. New York: Routledge.
- [26] Rahn, R. and R. Moraga. (2007). *The Study of Knowledge Retention and Increased Learning Through the Use of Performance Based Tasks*. Proceedings of the 2007 Industrial Engineering Research Conference, IIE Annual Conference, Nashville, TN., May 2007.
- [27] Sanders, D. W., & Marrison-Shetlar, A. I. (2000). Student Attitudes toward Web Enhanced Instruction in an Introductory Biology Course. *Journal of Research on Computing in Education*, 33(3), pp. 251-262.
- [28] Wiman, R. V., & Meierhenry, W. C. (1969). *Educational Media: Theory into Practice*. Merrill, Columbus, OH.