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Improving the Performance Practice of 21st Century Music of Grade 10 Students Through Digital Learning Material

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ABSTRACT

This study determined the effectiveness of ICT in teaching science concepts. This study utilized a true experimental design, specifically the pretest-posttest two-group design. A teacher-made test was used as pretest and posttest to assess the pupils' level of knowledge about science concepts. The subject of the study was a rural school in Ilocos Norte. One class was assigned as the control group while the other was the experimental group. Data were analyzed using frequency counts, percentage distributions, means, standard deviations, t-test of correlated of dependent samples and t-test of difference. The results showed a significant difference between the pretest and posttest mean scores of the two groups with their posttest mean scores being significantly higher than their pretest mean scores, indicating that the two methods were effective in teaching Science concepts. However, the results of the t-test of difference between the posttest mean scores of the two groups showed that the posttest mean score of the experimental group was significantly higher than that of the control group. This implied that the ICT integration were more effective than the lecture-discussion method in teaching science concepts to the grade five pupils.

INTRODUCTION

Many things are learned consciously and unconsciously using different strategies in absorbing and processing them. There is no right way of learning for a specific situation because everyone has his/her own style of learning which can vary from one situation to another. Because of the variety of learning theories and styles, one can choose from different strategies and styles in situations so as to use the most efficient one (Kahninen, 2008). Learning is a complex process where student motivation, teacher competence, learning material, and several other aspects interact with each other. Over the past few decades, the traditional classroom setting has gradually changed into a virtual environment. The technical revolution has dramatically changed the learning process, at the same time has brought about different opportunities to learn. But the different issues about learning that have to be taken into account are still the same. The basic learning concepts remain the same; students still have to be motivated and learning materials still have to be interesting and easily accessed. (Kahninen, 2008).

The world in which we live is changing rapidly and the field of education is striving to keep in step with these changes, particularly with regard to media services. The old days of an educational institution having an isolated audio-visual department are long gone! The growth in the use of multimedia within the education sector has accelerated in recent years, and looks set for continued expansion in the future. Teachers are primarily required to access learning resources which can support concept development by learners in a variety of ways to meet individual learning needs. The development of multimedia technologies for learning offers new ways in

which learning can take place in schools and home.

The e-learning materials covers different subjects and topics. There are commercially available packages which are produced by experts, which cover a wide range of subjects at the different levels of education. Another form of e-learning material which is used in teaching and learning is the teacher-made packages or improvised instructional packages. Both the commercially available and the improvised instructional packages are good and useful in teaching and learning science subjects but their effectiveness, adaptability, malleability and versatility depends on how well the teacher has been prepared to handle these (Etukodo, 2010). For commercialized e-learning materials, teachers are required to learn certain skills to be able to use them. The learners even need to develop the prerequisite entry behaviors that can enable them to handle or be taught with computer assisted instruction (CAI).

However, it should be noted, that using ICT materials provides an enhanced learning experience, especially so when the material is presented with pedagogical underpinning, is easy to navigate, is reflective, and well-thought out to enhance student learning and promote the development of active learners rather than passive recipients.

RESEARCH QUESTIONS

This study aimed to determine the effectiveness of ICT integration towards the different schools in Ilocos Norte. Specifically, it sought answers to the following questions:

1. What is the level of performance of the two groups in the pretest?

1.1 Is there a significant difference between the pretest mean scores of the two groups?

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2. What is the level of performance of the two groups in the posttest?

3. How effective are the two methods in teaching science concepts?

3.1 Is there a significant difference between the pretest and the posttest mean scores of the pupils in the group A?

3.2 Is there a significant difference between the pretest and the posttest mean scores of the pupils in the group B?

3.3 Is there a significant difference between the posttest mean scores of the two groups?

LITERATURE REVIEW

Status of Philippine Science Education

The average school and the larger society do not nurture science-oriented students. Science is taught in the elementary grades primarily as absorption of information from textbooks and the teacher, with little emphasis on observation, information gathering, and the sense of discovery. In high schools, experiments, if done at all, are “de kahon” where students go perfunctorily through the steps in procedures, without thought of whys, but rather with concern about getting the laboratory reports done and using “predetermined” results (Ibe and Ogena, 1998).

That is why the performance of Philippine students in the international standardized exams in science is among the lowest in the world. Identifying solutions is like walking into a cave without knowing where to go out. It is very likely that solutions drawn from mere presumption and prejudgments are not going to work, and problems will simply continue to linger. Science education in the country may even deteriorate further without paying attention to evidence.

The situation two decades ago has hardly changed. The usual perception of science and mathematics as being difficult subjects is carried over and perpetuated in college, and has resulted in very low success in all attempts to produce a critical mass of scientists for the country. There is still a very low percentage of high school students taking up science courses in the university.

Therefore, learning packages had to be constructed in order to help in the enlightenment of Science Education in the country. With the help of learning and instruction packages, learning is facilitated efficiently.

The ICT Material in Teaching

The e-Learning material is a form of computer-assisted instruction (CAI) that relies on and emphasizes effective and active classroom learning. The package is developed by using multimedia technology to increase learning effectiveness. An e-Learning material gives an opportunity for pupils to interact with and get feedback from lessons. The e-Learning material would be more attractive to pupils for this reason and would promote effective learning. One of the important things which enable pupils to understand concepts on a e-Learning Material is the use of multimedia that can stimulate

students’ attention because it can allow students to have fun during learning.

Elements of multimedia. The elements used in multimedia have all existed before. Multimedia simply combines these elements into a powerful new tool, especially in the hands of teachers and students. Interactive multimedia weaves five basic types of media into the learning environment: text, video, sound, graphics and animation. Since the mode of learning is interactive and not linear, a student or teacher can choose what to investigate next (Asthana, 2010).

Text is the most common medium of presenting information. It is also used to communicate a concept or an idea. It should effectively complement the other media. Factors that influence the textual communication are typeface, font and style, kerning, animation, special effects, special characters and hypertext. While dealing with text in multimedia it is very important to note that it is not the only means of communication. In multimedia, text is most often used for titles, headlines, menus, and navigation keys (Asthana, 2010).

Audio is another vital media in a multimedia presentation. Audio is available in different file formats and the appropriate file format is chosen to maximize its performance. Sound editors play an important role for converting file formats and also for enhancing the quality of sound. In most cases, sound files are imported and edited for a multimedia application (Asthana, 2010).

Video in multimedia is an extremely useful communication tool for presentations. It illustrates ideas and concepts besides capturing real world events (Asthana, 2010). Videos allow teachers to reach students who are visual learners and tend to learn best by seeing the material rather than hearing or reading about it. Teachers can access video clips through the internet instead of relying on DVDs or VHS tapes. Websites like YouTube are used by many teachers. Teachers can use messaging programs such as Skype, Adobe Connect, or webcams, to interact with guest speakers and other experts. Interactive video games are being integrated in the curriculum at both K-12 and higher education institutions.

Graphics is the most commonly used element of multimedia. The richness of multimedia and the effective communication are through graphic presentations. The attributes of color, texture, pattern and animation enrich a multimedia presentation (Asthana, 2010).

Animation is designed as a simulation of movement created by displaying a series of pictures or frames. Animation strictly is a visual illusion. It builds dynamism, energy and motion to inanimate objects. It also adds the dimension of time to graphics. Computer animation is relevant to multimedia as all the presentations are developed on the computer (Asthana, 2010).

“Make Me Genius” is an example of an effective e-Learning material that is readily available in the web. It was designed by Indian developers that aimed to promote science education in an easy manner of understanding.

Videos and the Brain

There are hundreds of volumes on the topic of the brain. However, the primary interest here is only on how a video is processed in students' brains to facilitate learning. This review covers: (a) core intelligences of verbal/linguistic, visual/spatial, musical/rhythmic, and emotional, (b) left and right hemispheres, (c) triune brain, (d) brain wave frequencies, and (e) video-brain conclusions.

Core intelligences. Among Gardner's 8.5 multiple intelligences verbal/linguistic, visual/spatial, and musical/rhythmic are core intelligences in every student's brain. Here are brief descriptions:

Verbal/linguistic: A person with this intelligence learns by reading, writing, speaking, listening, debating, discussing, and playing word games

Visual/spatial: This person learns by seeing, imagining, drawing, sculpting, painting, decorating, designing graphics and architecture, coordinating color, and creating mental pictures

Musical/rhythmic: This requires learning by singing, humming, listening to music, composing, keeping time, performing, and recognizing rhythm

These three intelligences are part of that unique profile of strong and weak intelligences that every student possesses. Neuroscience research has confirmed the physical difference in the neuronal networks of each student's brain (Zull, 2002). Instructors can only work with what each student brings to the classroom. This pluralistic view of the mind permits faculty to think of exposing their students to a wide range of learning strategies. Drawing from four to six intelligences allows virtually every student to use their strength intelligences as well as to strengthen their weaker ones. Videos can tap verbal/linguistic and visual/spatial, and even musical/rhythmic (Goleman's, 1998) emotional intelligence is also tied to videos. Intrapersonal intelligence involves self-reflection, self-direction, self-motivation, controlling impulses, planning, independent study, and metacognition; interpersonal emphasizes relating, cooperating, empathizing, teaching, leading, connecting with others, resolving conflicts, and social activities. The music alone in videos can elicit emotional reactions of liking or disliking and excitement or arousal (Macaluso, & D'Urso, 1994). Video clips can be used to communicate with learners at a deeper level of understanding by touching their emotions.

Left and right brain hemispheres. There are separate hemispheres of the brain that relate to two ways of thinking: verbal and nonverbal (Gazzaniga, 1992). The left hemisphere is predominately the logical and analytical side that processes information sequentially as in mathematics, logic, and language. It is also the verbal side that is structured, factual, controlled, rational, organized, planned, and objective (Miller, 1997). In contrast, the right hemisphere is the nonverbal, creative side which is spontaneous, emotional, disorganized, experimental, empathetic, subjective, intuitive, and seeking relationships. It focuses on art, color, pictures, and music (Jourdain, 1997).

A video clip engages both hemispheres. The left side

processes the dialogue, plot, rhythm, and lyrics; the right side processes the visual images, relationships, sound effects, melodies, and harmonic relationships (Hébert & Peretz, 1997).

Triune brain. A cross section of the brain would reveal that it has three layers: (a) the stem or reptilian brain (5%), which performs basic tasks, such as breathing, pulse, and heart rate, determines the nature of sound, its direction, volume, and its potential threat, (b) the inner layer or limbic brain (10%), which is the center of our emotions, reacts to videos with appropriate emotions and long-term memory, and (c) the outer layer wrapper bark called the neocortex or cerebral cortex brain (85%), which controls hearing, vision, language, and higher-level functioning and responds to the video clip intellectually (MacLean, 1990). The latter thinking brain absorbs the sounds of the reptilian brain and feelings of the limbic system and organizes them into a video production. This triune concept facilitates our understanding and creation of video clips.

Brain wave frequencies. Another aspect of brain functioning is brain wave frequencies. Among the four types of waves—Delta, Theta, Alpha, and Beta—that relate to various levels of consciousness, the Alpha and Beta waves have particular implications for videos. Delta deep sleep or Theta shallow sleep, deep contemplation and free-flowing creativity may be characteristic of students in classes where the instructor just lectures. Alpha waves occur when students are in a relaxed state of awareness, such as after they wake up in class. The right hemisphere is primarily engaged in Alpha when they're reading, studying, or reflecting.

The emotions are dominant and the left hemisphere's rationality drops out of sight temporarily. Slow, reflective, thought-provoking video clips foster Alpha waves. They relax the brain, which can be useful when reviewing content so it passes into long-term memory (Millbower, 2000).

Beta waves are the patterns of a fully awake mind, when the left hemisphere kicks into action. This is multitasking mode for the Net Generation of students. They are functioning at optimum speed. Fast action, Jackie Chan-Rush Hour, Mission: Impossible-type video clips can snap students to attention who are in a drifting Alpha or meditative Theta state. They are now super-alert, ready for whatever activities the instructor has planned.

Selecting Appropriate Videos

Choosing videos for classroom use involves several issues. This section provides guidelines for faculty in the following forms: (1) criteria for selection, (2) types of videos, and (3) sources for selecting videos. After this section, it will finally be time to consider 12 techniques for embedding video clips into teaching.

Criteria for Selection. Videos are rated from G for general audiences with no restrictions to NR where no one except rodents is allowed to watch it because it's so evil. More important are the content ratings for graphic violence, obscene language, nudity, sexuality, and gore. Commercial

movies and music videos are out of control. Anything and everything are used to attract audiences. If a video clip or the whole movie is going to be used as a teaching tool, criteria must be established for what is appropriate and acceptable in a teaching-learning context.

Each instructor should set his or her own standards for videos, just as standards may have already been set for other types of classroom behaviors, such as offensive humor (Berk, 2003), inappropriate or disparaging comments, and issues of civility. There are three sets of criteria that must be considered: (a) the students' characteristics, (b) the offensiveness of the video, and (c) the video structure. The first set of criteria relate to salient socio-demographic characteristics: age or grade level, gender, ethnicity, and language-dominance. Instructors know their students and these characteristics are a must consideration in choosing the right video.

The second set of criteria concerns the possible offensiveness of the video according the categories mentioned previously, plus content irrelevant to the reason for showing the video, such as: put-downs or ridicule of females, racial and ethnic groups, professions, politicians, and celebrities; mental or physical abuse of anyone; drug use; and other offensive content.

Clear standards for acceptable content should be delineated. The video is being used to facilitate learning, not impede it. A student who is offended by a video clip will withdraw, turn off, and harbor anger, which are emotions hardly conducive to learning. What is interpreted as offensive is a very personal decision by each student based on his or her own values, beliefs, and principles. The instructor should make every effort to reject any material that is even borderline or potentially offensive. The pool of available videos is large enough that picking the right stuff should not be a problem. If it is a problem, the instructor should seek counsel from colleagues who would be sensitive to such issues.

Finally, the structure of the video must be appropriate for instructional use. The following guidelines are suggested when creating video clips: (a) length, as short as possible to make the point, edit unmercifully to a maximum of three minutes unless the learning outcome requires a lengthier extract; (b) context, authentic everyday language use unless purpose relates to language; (c) actions/visual cues, action should relate directly to purpose, eliminate anything extraneous; and (d) number of characters, limit number to only those few needed to make the point, too many can be confusing or distracting.

Steps in Using a Video Clip in Teaching

The most common procedure for using a video clip in teaching consists of the following steps:

(1) Pick a particular clip to provide the content or illustrate a concept or principle; (2) Prepare specific guidelines for students or discussion questions so they have directions on what to see, hear, and look for. What's the point of the clip? Make it clear to the students; (3) Introduce the video briefly to reinforce purpose; (4) Play the clip; (5) Stop the clip at any scene to highlight a point or replay clip for a

specific in-class exercise; (6) Set a time for reflection on what was scene; (7) Assign an active learning activity to interact on specific questions, issues, or concepts in clip; and (8) Structure a discussion around those questions in small and/or large group format.

These eight steps are the basic elements in most content applications. Video clips can be used in that mold or the teacher can broaden his applications far beyond those steps. Seriously consider students' survey results on TV programs, movies, commercials, and music videos.

Another set of steps are as follows: (1) Provide Content and Information(2) Illustrate a Concept or Principle(3) Present Alternative Viewpoints (4) Apply Content to Real-World Applications (5) Serve as a Stimulus for Learning Activities(6)Provide a Good or Bad Application to Critique(7) Exaggerate a Particular Point(8) Snap Students to Attention(9) Insert into Collaborative Learning Exercises(10) Motivate and Inspire(11) Provide a Commercial Break(12) Signal Return from a Class Break.

Effectiveness of e-Learning Materials

E-learning produces great results by decreasing costs and improving performance. Also, unlike a one-time classroom session, the e-learning course is available for others. This includes the static e-learning course as well as any ongoing conversations in networked communities. With e-learning, each time the course is accessed, the return on investment improves because the producers are dividing the fixed production costs by number of use. It also has savings through decreased travel and reduced material. It decreases material cost, increases productivity and it supports learners' development. It has a real-time access and it gives people freedom to fail. The combination of multimedia and instructional design can produce a very rich learning experience that is repeatable. When good practice activities with feedback are added and have a learning environment that's going to help learners retain the course content, this will produce results. E-learning offers control to the learners in a way that classroom learning doesn't. Materials give ongoing access to resources and include all sort of online technologies. The foundation of a learning community is built on sharing with others.

E-learning is good for the environment. Britain's Open University's study found that producing and providing distance learning courses consumes an average of 90% less energy and produces 85% fewer CO2 emissions per student than conventional face-to-face courses. e-learning is cost effective and can produce great results.

ICT Uses, Benefits and Values Derived

A good program establishes an interaction circuit through which the user and the computer are apparently in a continuous communication. Researches into learning styles show that students learn better through specific modalities such as visual, oral and kinetic. The goal of interactive multimedia is to provide to the student the choice of these modalities in a learning environment (Crawford, 1990).

Besides being a powerful tool for making presentations, multimedia offers unique advantages in the field of education. For instance, text alone simply does not allow students to get a “feel” of any of Shakespeare’s plays. In teaching biology, an instructor cannot make a killer whale come alive in a classroom. Multimedia enables us to provide a way by which learners can experience their subject in a vicarious manner. The key to providing this experience is having simultaneous graphic, video and audio, rather than in a sequential manner. The appeal of multimedia learning is best illustrated by the popularity of the video games currently available in the market.

Moreover, under conditions of chronic under-funding, multimedia can provide an enhanced or augmented learning experience at a low cost per unit. It is here that the power of multimedia can be unleashed to provide long-term benefit to all. Multimedia enables learning through exploration, discovery, and experience. Technology does not necessarily drive education. That role belongs to the learning needs of students. With multimedia, the process of learning can become more goal-oriented, more participatory, and flexible in time and space, unaffected by distances and tailored to individual learning styles, and increase collaboration between teachers and students. Multimedia enables learning to become fun and friendly, without fear of inadequacies or failure (Reddi and Mishr, 2003).

There are different values and benefits attained when people learn to harness tools in teaching such as using a multimedia. It gives benefits to the learners, assimilation and retention of knowledge is increase, pace, texture and more creative structure makes the learning process more fun, interest, concentration, involvement and interaction levels will increase, accessible to the extensive range of subject areas.

Problems and difficulties met in using Multimedia.

The number and size of elements in the package will affect the access time while the multimedia components (for graphics, audio, animation, etc) are always of big size. There is always a tension between the minimization of the large files (for graphics, audio, animation, etc) and the maximization of the multimedia components. A compromise is that only those that can significantly enhance the program are used.

Related Studies about ICT Integration

Boster, Meyer, Roberto, & Inge (2002) examined the integration of standards-based video clips into lessons developed by classroom teachers and found to increase student achievement. The study of more than 1,400 elementary and middle school students in three Virginia school districts showed an average increase in learning for students exposed to the video clip application compared to students who received traditional instruction alone.

The study of Chan (2001) explored the effects of a problem-based computer-assisted instruction (PBCAI) on students’ earth science achievement in Taiwan. An analysis of covariance on the Earth Science achievement test posttest scores with students’ IQ and pretest scores

as the covariates suggested that the PBCAI was more effective in promoting students’ achievement.

Quintana (1979) developed, tried-out and validated learning activities on soil for intermediate pupils and on Philippine wildlife for secondary schools. These learning activities were found to be effective in providing meaningful experiences to students.

Cavanaugh’s synthesis (2001) of 19 experimental and quasi-experimental studies of the effectiveness of interactive distance education using video-conferencing and telecommunications for K-12 academic achievement found a small positive effect in favor of distance education and more positive effect sizes for interactive distance education programs that combine an individualized approach with traditional classroom instruction.

In the study of Roschelle, et.al. (2000) they found that computer technology can help support learning and is especially useful in developing the higher-order skills of critical thinking, analysis, and scientific inquiry “by engaging students in authentic, complex tasks within collaborative learning contexts”

Results from other studies of Perez-Prado and Thirunarayanan (2002) also suggest that students can benefit from technology-enhanced collaborative learning methods and the interactive learning process.

Means and Olson (2000) identified four fundamental characteristics of how technology can enhance both what and how children learn in the classroom: (1) active engagement, (2) participation in groups, (3) frequent interaction and feedback, and (4) connections to real-world contexts. They also indicate that use of technology is more effective as a learning tool when embedded in a broader education reform movement that includes improvements in teacher training, curriculum, student assessment, and a school’s capacity for change.

Cavanaugh, et.al. (2005) in their studies prove that simulations, manipulative, online tutoring and tutorials that offer student feedback can increase performance, decrease failure, and provide students with visual and cognitive support they need to master abstract concepts. ICT integration in education has its merits. Its use not only changes the traditional ways of teaching, but also requires teachers to be more creative in adapting and customizing their own teaching materials and strategies (Reid 2002). Among all the teaching methods and strategies, collaborative learning, problem-based learning, and the constructivist approach are the most widely used teaching strategies to deal with the challenges of ICT use (Abbott and Faris 2000). This corroborates the suggestion of Palak and Walls (2009), as well as Tezci (2011), that technology integration will not have the desired effect without student-centered classroom practices. Therefore, ICT integration in education cannot be implemented in isolation.

When it is applied in combination with diverse teaching methods and approaches, especially constructivist practices, learning outcomes may be more successful. On this basis, future researchers are recommended to

undertake studies related to the benefits and challenges of a combination of ICT and other student-centered approaches such as collaborative learning across

In order to explore teacher perceptions of school culture related to the level of ICT usage, Tezci (2011) examined Turkish teacher perceptions from both the technical and motivational perspectives. The results showed that their perceptions from both perspectives were not positive, because the majority did not believe that they would receive adequate technical and motivational support from their school. However, as the school culture became more positive, the teachers' ICT usage level increased.

Ward and Parr (2010) stated that teachers need to feel confident in their ability to facilitate student learning with technology in order to integrate technology into their classrooms. To achieve this goal, more professional development is required with a focus on increasing teachers' skills so that they are able to overcome apprehensions associated with using technology.

Further, Ertmer and Ottenbreit-Leftwich (2010) believe that new teaching approaches and technical support should be offered by schools to allow them to retain control while facilitating learning with computers. Overall, implementing effective teaching with technology integration requires changes in teachers' knowledge, beliefs, and school culture.

The Annual Survey of Trends in Education¹⁰ shows an increase in the provision and availability of ICT in schools. The head teachers' survey identified a variety of funding sources for ICT including: school budget; government grants; supermarket voucher schemes and parent/teacher associations. The majority of respondents recognized the potential of ICT, and the Internet in particular, for teaching.

Technical support is perceived to be the responsibility of the teacher by half of the respondents to the Annual Survey of Trends in Education. However, not time is allocated to the task. Only 12 per cent of schools employed a specialist technician.

A survey of schools undertaken in 23 countries by the Organization for Economic Co-operation and Development (OECD) and the Cognitive Enhancement Research Institute (CERI) revealed barriers that inhibit the use of ICT in teaching generally. Lack of opportunities for staff development during working hours, teacher resistance resulting from personal teaching styles and/or negative attitudes towards ICT, and limited infrastructure (especially technical support) are identified as inhibiting progress towards transformation in schools.

Venezky (2002) cites cases where teachers are reluctant to integrate ICT into their practice. The reasons given include: fear of technical problems, and a preference for traditional teaching methods. There are cases in evidence where the integration of ICT has been successful in spite of technical problems. For example, in Germany, ICT competence amongst staff and a 'critical level' of ICT infrastructure are perceived to be the key critical success factors for the implementation of ICT in teaching and

learning. However, staff training is not necessarily a prerequisite for implementation. The research also reveals inconsistencies between ICT training and its application in the classroom, suggesting that some staff do not have the confidence to put their learning into practice. In the case of Sweden, staff turnover is perceived as a barrier to sustainability.

One study, commissioned by the Department for Education and Employment in Scotland, aimed to evaluate the influence of computer technology on the career 'preparedness' of students in schools, the careers education and guidance process in schools, and the integration of schools and careers services. A simple relationship between 'preparedness' and ICT was not identified. Indeed, computer support had little or no impact on the guidance interview itself. Pupils who were 'better prepared' had been engaged in a structured, careers education programme that was supported by staff and senior management. In addition, their schools had established a good relationship with the careers service.

Research commissioned by the Department for Education and Skills (DfES) and carried out by the Northern Economic Research Unit at the University of Northumbria identified a range of key factors affecting ICT usage. Engagement with ICT is perceived as standard practice and beneficial in terms of providing effective ways of managing large quantities of information. ICT can enable young people to self-help by providing answers to questions relating to jobs, careers, education and training. However, ICT is not considered to have a role in career planning.

The study of Lee and Hu (2008) explored some possibilities of conducting design-based research on contemporary learning. It was observed that unexpected emergence of systemic changes, or even transformation, seemed quite common at the level of a course.

Kahigi (2013) who studied the integration of e-learning into the education system viewed e-learning as one of the responses to meet growing need for high quality education. It focused on how collaborative e-learning can be integrated in the teaching and learning process to support learning at the university level in a developing country.

Dietinger (2003) explained that the technological basis e-learning environments, proved to be an appropriate tool which can support the learning process efficiently, effectively and satisfactorily. In the future they will open up to a new dimensions in the world of learning we never experienced before. With their help the right knowledge will be learnt at the right time, by the right person, in the right context.

Bose (2003) studied and reported the experience of an e-learning pilot project selected by the Educational Technology Unit (EduTech) of the Centre for Academic Development (CAD), University of Botswana (UB). This course utilized a student centered e-Learning package that retained the learning qualities of traditional teaching, personal guidance, and mentoring, while seeking to

enhance students' research and computer skills. The study of Goh (2007) on multiplatform e-learning system of evaluation played an important role for e-learning systems designers to improve the adaptation process and to enhance the level of learner satisfaction in multiplatform e-learning systems. In the paper of Shah and Fatul (2006) they found out that there is a positive result on the impact of e-learning has brought to tertiary level of students adopting e-learning and that the contribution of modern technology has brought almost achieving quality education. Jones (2011) answered the problem of how to design, implement and support information systems that effectively and efficiently support e-learning within universities. This problem is increasingly prevalent and important to the operation of universities. Chusovlyanova and Chusovlyanova (2013) devoted to the development of e-learning package used in English language teaching and learning in technical universities in Russia and proves to be effective. The study of Kybartaitė et.al (2007) revealed that there exist theoretical and practical possibilities to create high quality e-learning education for biomedical engineering compared to traditional method. Zehry et.al (2011) proves in their study that e-learning resources within medical education facilitate the learning process for medical professionals especially in the current era where there is a great emphasis on lifelong learning and competency-based education. The study of Wu (2002) demonstrated that it is possible to build a reusable and adaptive e-learning system based on learning objects and XML technologies. This system provides four tutorial courses, which illustrated the reuse of learning objects and the distribution of individually tailored learning content. These studies revealed that e-learning materials developed and validated based on the abilities of the learners helped improve their specific skills. The studies bared the importance of e-learning in the life-long learning process of diversified learners as it enhanced their skills and mastered concepts.

METHODOLOGY

This study utilized a true experimental design, specifically the pretest-posttest two-group design where two sections of grade five pupils of a rural school in Ilocos Norte. One section was randomly selected as the group A and

the other as the control B. A pretest was conducted to the two groups and their scores were statistically compared. The experimental class was taught the science concepts using the e-learning materials, while the control group was taught the same lessons using the traditional method. After all the lessons were taught to the groups, a posttest was administered and their scores were compared with the pretest scores of each group to determine the gain of each, then the posttest results of the two groups were statistically compared to determine which method was more effective. The main instrument used in this study to gather data was the Test on Concepts constructed by the researcher to test the level of performance of the pupils in forming science concepts. Test on Concepts. This is a 50-item multiple choice teacher-made test constructed by the researcher on the different science concepts. It was used as a pretest to determine the level of performance of the pupils about the different science concepts on the following topics: rocks, rocks cycle, weathering, erosion, earth, atmosphere and its layers, global warming, weather, climate, water cycle, solar system and the moon. The same set of test was used as a posttest to determine the level of performance of the pupils on science concept formation. The following statistical tools were employed to analyze the data for this study: Frequency distributions, means and standard deviations were used to describe the level of performance of the pupils in the experimental and the control groups in the pretest and posttest. The t-test of difference between means of two correlated or dependent samples was used to test the significance of the difference between the pretest and posttest mean scores of the pupils in each of the two groups. The t-test of difference between means of two independent samples was used to compare the posttest mean scores of the experimental and control groups. In all tests of significance, the level of significance was set at the .05 probability level.

RESULTS AND DISCUSSION

Level of Performance of the Two Groups in the Pretest

The frequency and percentage distributions of the pretest scores of the two groups are shown in Table 1. Results show that in Group A, 22 (59.46%) of the pupils

Table 1. Distribution of pretest scores of the two groups.

Scores	Descriptive Interpretation	Group A		Group B	
		F	%	F	%
41-50	Outstanding	0	0.00	0	0.00
31-40	Very Satisfactory	1	2.70	2	5.41
21-30	Satisfactory	14	37.84	8	21.62
11-20	Fair	22	59.46	24	64.86
0-10	Poor	0	0.00	3	8.11
Total		37	100.00	37	100.00
Mean		19.57 (Fair)		17.81 (Fair)	
*SD		5.97		6.65	

got scores within the range 11 to 20 with a descriptive interpretation of fair, while 14 (37.84%) got scores within the range 21 to 30 and with a descriptive interpretation of satisfactory, and only one (2.70%) got a score within the range of 31 to 40 and with a descriptive interpretation of very satisfactory.

In group B, 24 (64.86%) of the pupils got scores within the range 11 to 20 with a descriptive interpretation of fair, while 8 (21.62%) got scores within the range 21 to 30 with a descriptive interpretation of satisfactory, and 2 (5.41%) pupils scored within the range 31-40 and got very satisfactory rating. The mean scores of the two groups which are 19.57 and 17.81, respectively, indicate that the pupils have fair level of knowledge on the concepts covered in the study. This indicates that the pupils are not yet fully aware of the science concepts.

Table 2. Results of the t-test of difference between the pretest mean scores of the two groups.

Group	N	Pretest Mean Score	Difference	T-Value	Probability
A	37	19.57	1.76	1.196ns	.236
B	37	17.81			

ns – not significant
 *E-Experimental
 *C-Control

Table 3. Distribution of posttest scores of the Two groups.

Scores	Descriptive Interpretation	Group A		Group B	
		F	%	F	%
41-50	Outstanding	7	18.92	2	5.41
31-40	Very Satisfactory	20	54.05	7	18.92
21-30	Satisfactory	8	21.62	18	48.65
11-20	Fair	2	5.41	10	27.03
0-10	Poor	0	0.00	0	0.00
Total		37	100.00	37	100.00
Mean		19.57 (Very Satisfactory)		17.81 (Fair)	
*SD		5.97		6.65	

*Standard Deviation

The mean score of group A is 34.41 with a descriptive interpretation of very satisfactory while the control group has a mean score of 26.00 with a descriptive interpretation of satisfactory.

Effectiveness of the ICT Integration in Teaching Science Concepts

Table 4 shows the results of the t-test of difference between the pretest and posttest mean scores of the two groups.

It can be gleaned from Table 4 that the pretest mean score of the group A (19.57) is significantly lower than its posttest mean score (34.41) as evidenced by the mean difference of (14.84) with a computed t-value of 18.541 that has a probability of 0.000 which is less than the .01 level of significance. Also, in the group B, the pretest mean score (17.81) of the pupils is significantly lower than their posttest mean score (26.00) as evidenced by the mean difference (8.19) with a computed t-value of 9.296 with a probability of 0.000 which is less than the .01 level of significance.

Comparing the pretest mean scores of the two groups, the results of the t-test displayed in Table 2 shows that the pretest mean score of the pupils in the group A (19.57) is not significantly different from the pretest mean score of the pupils in the group B (17.81) as indicated by the computed t-value of 1.196 with a probability of .236 which is greater than the .05 level of significance.

This finding implies that the pupils in both groups have more or less the same entry level of knowledge about the science concepts covered in the study, hence the two groups are equivalent.

Level of Performance of the Two Groups in the Posttest

Table 3 displays the distributions of the posttest scores of the two groups. In the group A 20 (54.05%) of the pupils had a very satisfactory performance as they got scores within the range of 31 to 40 while the rest got scores within the range (8 or 21.62%) 21 to 30 and 41 to 50 (7 or 18.92%) which are described as satisfactory and outstanding, respectively.

In group B, 18(48.65%) of the pupils got scores within the range of 21 to 30 in the satisfactory level, 10 (27.03%) got scores within the range of 11 to 20 in the fair level, and 7(18.92%) are within the range of 31 to 40 in the very satisfactory level and 2(5.41%) are within the range of 41-50 under the outstanding level.

Results of the t-test of difference between the pretest and the posttest mean scores of both the two groups indicate a significant increase in the mean posttest scores of both groups. These further imply that the pupils in both groups have gained significantly and had clearer understanding of the science concepts coursed in the lessons presented to them.

Comparing the posttest mean scores of the two groups, it can be deduced from the results of the t-test presented in Table 5 that the posttest mean score of pupils in the group A (34.41) is significantly higher than that of the posttest mean score of the group B (26.00) as indicated by the computed t-value of 4.796 with a probability of .000 that is less than the .01 level of significance. This indicates that the pupils in the group A having obtained the higher posttest mean score were able to develop better understanding of the science concepts covered in the study than their counterparts. This implies that the use of ICT materials is more effective in teaching Science concepts than with the use of the traditional-lecture-

Table 2. Results of the t-test of difference between the pretest mean scores of the two groups.

Group	N	Pretest Mean Score	Posttest Mean Score	Mean Difference	T-Value	Prob.
E	37	19.57	34.41	14.84	18.541**	.000
C	37	17.81	26.00	8.19	9.296**	.000

**Significant at the 0.01 probability level

*E-Experimental

*C-Control

Table 2. Results of the t-test of difference between the pretest mean scores of the two groups.

Group	N	Pretest Mean Score	Difference	T-Value	Probability
Experimental	37	34.41	8.41	4.796**	.000
Control	37	26.00			

**Significant at the 0.01 probability level

discussion method.

Interested and focused on their lessons.

The results of the study are in consonance with the findings of Becta (2003) and Cass et.al (2008) that e-learning materials is very practical and useful for instructional purposes. Students are satisfied with the active learning model, and the students are also provided more opportunity to learn by themselves which results in their higher learning achievement. An e-learning material can make science more interesting, authentic and relevant. It allows more time for observation, discussion and analysis and increases opportunities for communication and collaboration.

CONCLUSION

Based on the findings of the study, the following conclusion was drawn:

The materials contain graphics and illustrations that further discussed the content of the lessons. They give an easier approach to the different concepts in science. They provided the pupils activities and let them experience and understand the concepts in Science through animations. Using these, the learner interacts with objects and events and thereby gains an understanding. The use of the materials helped the pupils discover and construct facts about Science. The ICT materials provided meaningful activities that helped them learn more about Science, thus it enhanced the pupil's abilities.

The result of this study affirmed the theories of Brunner on Constructivism (1966), Dewey on experiential learning (1971), as well as the Cognitive Information Processing Theory that learning is facilitated if it is gained through new experiences that include new types of strategy wherein knowledge is not received from outside, but is formed by reflecting on one's experiences, and by fitting new information together with what they already know.

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