EXPLORING STUDENTS' PERCEPTIONS AND CONCEPTUAL UNDERSTANDING IN A NEXT GENERATION BLENDED LEARNING (NXGBL) PHYSICS CLASS

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Abstract

This study aimed to explore students’ perceptions and conceptual understanding in studying energy and momentum concepts using the NxGBL approach. NxGBL involves merging mobile devices, multimedia, and face-to-face instruction to empower personalized and progressive learning processes for the students to be equipped to cultivate modernization competence. It is a digital ecosystem involving students, instructors, content, and tools to support effective and efficient learning processes directly. Hence, it is necessary to obtain a new learning environment that subsequently developed into pedagogical approaches known as blended learning, flipped learning, and personalized learning. The combination of these techniques was used to carry-out lessons and in designing assessments covering energy and momentum concepts for a period of 2-weeks in one class. One group pretest-posttest design was used and conducted on 30 Grade 12 students under the STEM strand. Students’ conceptual understanding was measured using Energy and Momentum Conceptual Survey (EMCS), while perceptions and learning experiences were gathered through a survey-questionnaire, journal reflections, and post-individual interviews. Results suggested that employing the NxGBL approach has potentials in increasing students’ achievement in Physics.

Keywords: conceptual understanding, perceptions, next-generation, EMCS, blended learning

Introduction

In recent years, the demands and difficulties of everyday life and work have sustained a metamorphosis brought about by rapid overture in innovation, technology, and globalization, preeminently in education. Consequently, propositions and resolutions have been made for educational reforms in regenerating our students with a new set of skills to prevail in this world of dynamic challenges (McFarlane, 2013). To appreciate the ever-changing bounds of mindsets and new technologies, new ideas and proposals requiring collaboration, innovation, soundness, and greater flexibility outdistanced the analysis and deductions based on rigid and linear thinking. (Assessment, Curriculum, and Technology Research Center, 2015).

According to research, a blended learning strategy has been proven to contribute to various advantages and benefits as recognized by students and educators. Advantages include revisiting missed lectures or not fully understood hypotheses, resulting in a more in-depth understanding of the concepts. Hence, resulting in enhanced academic performance. The use of technology, coupled with proper teaching strategy, may lead to a compelling result of academic performance. Learning outcomes tasks can lead to optimum achievement if appropriate technology platform is applied to assist the progress of the teaching and learning process (Rovai and Jordan, 2004). Technology has been a powerful engine thrusting a revolution in the landscape of education in terms of content delivery from a wide range spectrum of classroom pedagogies (Wedlock and Grove, 2017). Teachers and administrators have been looking towards the uprising of the different technologies that would result in a transformation in education. Students are hooked and engaged in rich, authentic experiences that will catch their attention to learn more. Furthermore, technology has been very unpredictable in terms of the wide vast of possibilities of its capacity to produce powerful learning tools; therefore, the academe needs to follow an approach that would consider the context of the learning environment, fluidity, and flexibility of using different technological tools in helping to improve and enrich both teachers’ and students’ learning experiences (Hamilton et al. 2016). Hence, adaptation and modification of teaching and learning processes may be necessary to keep the students’ interest leading to positive end products.

In developing a 21st-century curriculum, teacher-designers should acknowledge appropriate learning tools to provide the needs of the learners while producing authentic tasks that would enable them to apply concepts learned in the real world. Creating an ideal digital learning environment entails the effective use of interactive platforms or Learning Management Systems (LMSs), empowering the learners to interact with the content, instructor, and other learners. Additionally, utilizing new instructions and
technologies will result in a significant gain of knowledge and make meaning an extensive understanding of the learning experiences (Kabbasi et al., 2016). In LMSs, teachers render a paramount role since they are the architects of the pedagogies to be employed in a blended learning environment. Moreover, different research studies have validated that students have a positive attitude in using technology. Accordingly, a positive outcome is anticipated to fulfill the learners (Cavus and Zabadi, 2014).

Despite the availability of learning technology platforms and tools, building a connection between reality and classroom experiences has not empowered teaching and learning structure to match the millennial generation (Wedlock and Growe, 2017). Brown et al. (2015) reported that the use of LMSs had been geared more towards supporting instructor’s and students’ administrative tasks than being used in the actual teaching-learning process. Furthermore, LMS as a platform would just be utilized for lecture materials distribution, attendance checking, and submission purposes which are not directly contributory to the students’ success in learning. With these changes in the landscape of education, there is an obvious mismatch of the existing systems and educational frameworks in terms of the use of LMSs, learning activities, and settings. Although broadly embraced by educational institutions, such supporting systems are progressively centered around the administration of learning instead of facilitating the learning procedure itself (Cheong et al. 2016). A study conducted by Cook and Obexer (2014) resulted in common feedback that the use of traditional LMSs does not promote high levels of interactivity among instructors, students, and the system itself. LMSs were designed under the assumption that what happens in the course must stay in the course, making it a private community or a walled garden (Stephens, 2011). This “wall” serves as a barrier to potential outside participation, resulting in a limited interaction of a real professional environment. Hence, the ultimate goal of balancing an environment within LMSs with experience beyond the walled garden should be part of the learning process. This has resulted in the idea of Next Generation Digital Learning Environment (NGDLE), a digital ecosystem involving students, instructors, content, and tools to directly support effective and efficient learning processes (Brown et al. 2015).

Next Generation Blended Learning (NxGBL)

One of the recent trends in instruction is the updated version of systems supporting these changes in higher education over the existing functionalities of LMSs termed as Next Generation Digital Learning Environment (NGDLE). NGDLE, for what should come after the LMS era, was endorsed by Bill and Melinda Gates in 2010, which is prominently influenced by the principles of constructivism, connectivism, situated learning, and complexity theory (Fraser and Ling, 2014). According to Brown et al. (2015), the “next-generation” materializes after being enlightened by the current learning-centered model that progressively represents higher education practice. The digital technology has evolved into a component of practically all teaching and learning practices, so the next generation essentially must likely be digital and is designed to enhance interactivity lacking in traditional LMSs. It is necessarily about learning, because learning connects the teacher and the learner and that this new learning environment will be more student-centered and less instructor-centric. Finally, it is imperative to be an interdependent, progressing, and productive ecosystem or environment, community of instructors, learners, content, and tools. This means that although NGDLE may consist of a conventional LMS as a component, it will not be a single application; rather, the NGDLE will be an ecosystem of sorts. As attested by Bill and Melinda Gates, NGDLE must tackle the following five (5) core functional dimensions in realizing the full potential of the approach: (1) interoperability and integration, (2) personalization, (3) analytics, advising, and learning assessment, (4) collaboration, and (5) accessibility and universal design.

Stimulated by the accomplishments of Bill and Melinda Gates, De La Salle Santiago Zobel (DLSZ) grasped the significance of bringing into existence the technology-supported learning environments. To accommodate DLSZ students who will be regenerated as more active, collaborative, constructive, authentic tasks and goal-oriented learners, the abovementioned barometers for NGDLE have been remodeled. DLSZ has named this the "Next Generation Blended Learning (NxGBL)" approach, which intensifies flexible learning styles and reinforces personalized learning. Moreover, NxGBL provides challenging, relevant, engaging, collaborative, and interactive and progress/goal-oriented learning experiences. Hence, it is necessary to obtain a new learning environment that subsequently developed into pedagogical approaches known as blended learning, flipped learning, and personalized learning (Calamlim, 2018). These 21st-century teaching styles are integral parts of how an NGDLE approach shall be taken by the union and dynamics of the "digital environment" tool and its users (Trestini, 2018).

The DLSZ has set to stimulate the spark of each Lasallian student as it continues to yield a gilt-edge, learner-centered atmosphere that creates perennial learners who are reflective, creative, critical thinkers, and problem-solvers in an innovative and transformative learning environment to acknowledge the
needs of the 21st-century learners. The DLSZ is visualized as the pioneer in technology-supported learning in Philippine education through “Next Generation Blended Learning (NxGBL),” which is the kind of learning that combines the application of technology into classroom instruction and learning. NxGBL implicates the merging of mobile devices, multimedia, and face-to-face instruction to empower personalized and progressive learning processes for the students to be equipped to cultivate modernization competence.

Upon making use of various significant technology-based classroom instructions aimed to improve performance, and in response to DLSZ’s implementation of the NxGBL approach, the school needs empirical and realistic methods that can be utilized to convey the needs and demands of the 21st-century learners accordingly. This study explores students’ perceptions and conceptual understanding in studying energy and momentum concepts through the use of the Next Generation Blended Learning (NxGBL) approach in designing 21st-century e-learning plans and assessments in physics education.

Impacts of Using Learning Management Systems

Based on the related studies, the utilization of LMSs is recognized by students and educators to give many advantages and benefits in the teaching and learning process (Cavus et al. 2006; Wilson et al. 2007; Halawi et al. 2009; Cheung and Slavin, 2012; Awada, 2016; Goldstein et al. 2017a; Irawan et al. 2017b; Zulfiqar et al. 2018a; Prescott et al. 2018b). Likewise, using LMSs or any online platforms in executing the lessons may generate significant positive effects (ES = 0.15 to 2.19) in juxtaposition to conventional methods. However, there are assertions that the differences in the impact of some studies (Halawi et al. 2009; Cheung and Slavin, 2012; Cheung and Slavin, 2013; Goldstein et al. 2017; Zulfiqar et al. 2018) on the students’ performance were mainly based on the following factors: (1) sample size (Halawi et al. 2009; Cheung and Slavin, 2012; Cheung and Slavin, 2013); (2) types of educational technology application (Cheung and Slavin, 2012; Cheung and Slavin, 2013); (3) professional development of teachers (Halawi et al. 2009; Cheung and Slavin, 2012; Goldstein et al. 2017); (4) framework model (Halawi et al. 2009) and (5) variations in instructional methods (Halawi et al. 2009; Goldstein et al. 2017).

A substantial number of studies on blended learning (Cavus et al. 2006; Sharples et al. 2015; Prescott et al. 2018; Awada, 2016; Irawan et al. 2017) assessed the developed instructional materials comparing pretest and posttest results. These aimed to substantiate the efficacy of their materials by validating the increase of learner achievement after the execution of the approach. As Cheung and Slavin (2012) stated in their analysis, implementing an online course with small sample size, students’ pertinent level of preparedness and familiarity with the application may lead to modest satisfactory results on students’ learning outcomes. Furthermore, the teachers’ crucial role on designing, implementing and evaluating blended learning lessons using LMSs must be taken into consideration, and the use of a distinct framework when designing learning plans as these factors has an impact on students’ performance (Halawi et al. 2009; Cheung and Slavin, 2012). The success of the level of technology integration used in the teaching and learning process may be based on the teachers’ technological pedagogical content and Bloom’s taxonomy frameworks (Halawi et al. 2009; Sharples et al. 2015; Goldstein et al. 2017). Results indicated that using an LMS corroborate to be a positive pedagogical approach in heightening and engrossing the learning experiences of the students as reflected on the effect size ranging from 0.37 to 2.19 (Cavus et al. 2006; Sharples et al. 2015; Prescott et al. 2018; Awada, 2016; Irawan et al. 2017). Countless of these methods is best accomplished by using an LMS or software to present supplemental opportunities to enhance important concepts and ideas.

Consistent with the preceding analysis of the same target, the outcomes propose that educational technology applications predominantly led a large irrefutable outcome on the students’ accomplishment which are mostly founded on a quasi-experimental mixed-method research design (Cavus et al. 2006; Sharples et al. 2015; Awada, 2016; Irawan et al. 2017; Prescott et al. 2018). The empirical results of the reviewed studies advocate that there was a significant distinction among the constructs of students’ achievement and anterior knowledge, perspective, and acceptance of using technology applications in classroom instructions, as these were positively associated with the teachers’ preparation and attempts of implementing and assessing blended learning lessons.

In the modern-day digital technologies and the birth of the 21st-century learners, carrying out authentic tasks can lead to maximum achievement in schools if proper technology is utilized to facilitate the teaching and learning process. Teacher-designers should examine appropriate classroom tools to supply the essential help learners need and devise authentic tasks that would empower them to apply concepts learned in the community. Creating an exemplary learning environment involves the effective use of interactive
platforms enabling the learners to interact effectively and efficiently with the content, instructor, and other learners (Cavus et al. 2006; Awada, 2016; Irawan et al. 2017).

Based on the literature, researchers have different reviews and feedback on the impact of using LMSs as a tool for improvement in a digital learning environment. However, there seems to be a shortage in research concerning studies in which instructional interventions employing the NxGBL approach are utilized to promote active and positive achievement and participation of students in learning high school physics concepts. Only a few studies have been clear as to the details of the methodologies employed with the incorporation of LMS as a tool for learning.

This research aims to explore students' perceptions and conceptual understanding through the use of the Next Generation Blended Learning (NxGBL) approach in designing a 21st-century e-learning plan and assessments in physics education. Specifically, the study intends to answer the following questions:

- What are the students' perceptions on the use of Next Generation Blended Learning (NxGBL) approach in studying energy and momentum concepts in terms of (a) conceptual understating; and (b) autonomy.
- Is there a significant change in the students' level of conceptual understanding after the instruction?

Methods

The research is an interventional, purposive, one group pretest-posttest design that investigated the effectiveness of the NxGBL approach, primarily focusing on the following teaching styles — blended, flipped, and personalized learning. The combination of these techniques was used to carry-out lessons and in designing assessments covering energy and momentum concepts for a period of 2-weeks in one class. A total of 30 Grade 12 students under the STEM strand were purposively selected as the participants of this study. Students' conceptual understanding was measured before and after the instruction using Energy and Momentum Conceptual Survey (EMCS) developed by Rosengrant and Singh (2003), while an adapted instrument by Varthis (2016) was used to measure students' perceptions on the use of NxGBL approach in the classroom instructions. In the duration of the study, an instructional module termed as Next Generation Blended Learning (NxGBL) learning plan and assessments were utilized by the researchers in carrying out the activities for 12 days.

EMCS is a 25-item multiple-choice test instrument used for measuring students' conceptual understanding for the following topics — Work, Energy, Conservation of Mechanical Energy, Impulse and Momentum, Collisions, and Conservation of Momentum. On the other hand, certain modifications were made on Varthis' 5-point Likert and 31-item questionnaire for measuring students' perceptions of the NxGBL approach. The changes made were designed to conform with the NxGBL approach being used in the school setting since the instrument was used originally for dentistry college students. The adapted instrument has a 4-point scale measurement, which was: (1) Strongly Disagree, (2) Disagree, (3) Agree, and (4) Strongly Agree to force the respondents to decide on the level of the agreeableness of each of the 31 items. Interview questions and reflective journal template was also used to gather students' experiences in terms of conceptual understanding and autonomy while learning the concepts. The initial drafts of the modified perception questionnaire, NxGBL learning plan and assessments were checked and validated by six (6) Science experts, particularly in the field of Physical Science education and NxGBL instruction using an adopted scoring rubric of Sarmiento (2017) and 21st-century e-learning Module Assessment Tool (21CELMAT) of Calamlim (2018). 21CELMAT was used to evaluate the developed 21st e-learning physics plans reflecting the uses of the different NxGBL approaches, namely: blended learning, flipped learning, and personalized learning. Specifically, this tool determines the quality of a learning plan in terms of self-paced learning, out-of-class activities, live events, in-class activities, collaborative activities, diagnostic assessments, summative assessments, flexibility, and personalization. Upon a series of consultations with the experts, the final drafts of the research instruments have incorporated all the suggestions and comments of the validators before the actual implementation.

The group was given a pretest before the instruction to determine the level of understanding they have on the topic. Students were engaged to a variety of technology-enriched activities such as lesson playlists, station rotation, flipped classroom, gamified instruction, brainstorming, collaborative work, whole class general blended learning, virtual experiments, group reporting, problem and inquiry-based learnings using different platforms and tools such as Google Classroom, Nearpod, Google Slides, Google Forms, Kahoot, Quizizz, etc. Formative and summative assessments were also included in the duration of the two weeks implementation. Design and use of NxGBL spaces were based on the frameworks formulated by Fraser and Ling, (2014), Puenteaura, (2010) and technology integration matrices provided by the Florida Center for Instructional Technology (2014, as cited in Harmes et al. 2016), while assessments were designed
and incorporated with the works of Crisp (2014). After this, the group was given a posttest and was asked to answer a journal reflection questionnaire. Selected students were also invited for an interview regarding their experiences in the duration of the study.

Descriptive statistics such as frequency count, means, and percentages were used to ascertain the student respondents' level of perception. Thematic analysis was employed to probe patterns and themes of students' opinions on the use of technology through online reflective journals and post-individual interviews. Paired t-test was used to determine if there is a significant change in the students' level of conceptual understanding before and after the instruction. Cohen's d was also computed to determine if the approaches implemented showed a large effect on the students' achievement. Cronbach's alpha was also determined for the reliability of the adapted perception questionnaire.

Results and Discussion

Students' Perceptions

Based on the responses, students perceived the implementation of different approaches in an NxBGL environment to impact their learning positively. On a scale of 1 to 4, 4 suggesting a positive perception, the mean value of the responses on the pedagogical approaches employed is 3.3771, with a standard deviation of 0.3574. This mean perception score shows a definite level of acceptability. This approach has encouraged them to use online tools and instructional videos, which helped them expand the information they have learned already in class. Furthermore, the NxBGL environment allows them to receive immediate feedback online, provides an opportunity to review contents, and promotes greater flexibility and self-regulated learning.

As regards to the students' experiences in an NxBGL environment, students revealed that the use of the different technology-based activities in this learning space have helped them understand lessons on energy and momentum, since these enabled them to have more access to other materials, allowed them to learn at their own pace and revisit lesson playlists, and kept them motivated. Table 1 shows the summary of the students' responses from the reflective journal and were tallied based on the prevailing answers of each student per question to get the common themes.

<table>
<thead>
<tr>
<th>Common Themes</th>
<th>Frequency</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Helpful in understanding the topic</td>
<td>25</td>
<td>83.3</td>
</tr>
<tr>
<td>Self-paced</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>Varied presentations</td>
<td>7</td>
<td>23.3</td>
</tr>
<tr>
<td>Access to other materials</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>Able to revisit learning materials</td>
<td>3</td>
<td>10.0</td>
</tr>
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</table>

Generally, the students perceived the implementation of the NxBGL approach as very helpful in understanding energy and momentum concepts as shown by the computed percentage of 83.3 %. Positive responses from 25 students include common comments such as “helped me take my knowledge to a deeper extent,” “concepts were presented in various forms,” “lessons were presented in an entertaining and understandable manner,” or “provides an opportunity for deeper understanding.” Following the first theme, students' selected responses from interviews are presented below:

“I believe that the use of Google Classroom as a forum helped me understand the topic more clearly compared to the traditional way of teaching. This is because it allows me to see the opinion and thoughts of my other classmates.” – Student A

One of the activities prepared using an LMS was a Google Classroom forum where conceptual questions were raised to be answered by the entire class by commenting on the thread. Student A found this activity very helpful and engaging since he was able to reflect on the opinions and ideas of his classmates. Through this, he was able to review also outside the classroom how the questions were correctly answered in the discussion forum.

“The integration of blended learning activities allowed me to be able to catch up with the class but also to learn at my own pace. I was able to go back to notes during face-to-face discussions, as well as with the online class discussions. Not only that, with different activities such as blended learning, but we were also able to incorporate
Clearly, Student B found the implementation of the different pedagogical approaches in helping them on learning physics concepts at their own pace. NsGBL has provided him and his classmates various ways on how to gain knowledge before, during, and after class using Google Classroom and Nearpod LMSs as he was able to discuss among the others his thoughts and ideas on the topics. With the aid of technology, he believed that the class experienced positive effects by making them more active in participating in different class dynamics by means of collaboration and effective communication online. Parallel results were also observed on the works of various research studies (Cavus et al. 2006; Sharples et al. 2015; Awada, 2016; Irawan et al. 2017; Prescott et al. 2018) which presented that digital learning environment is proven to be useful and effective to inculcate quality learning independently.

One of the approaches implemented in this study was flipped learning; students have commented on its effectiveness in helping him to grasp physics concepts. The following are some sample answers:

“Flipped classroom helped a lot in the process of understanding and communicating with my classmates. It does not only enhance my ability to use technology but also to interpret and understand lessons in a manner that gives me the opportunity to express my technological and research skills. I prefer online and live discussions so I can collaborate with my teacher and classmates” – Student C

“For a theory-heavy subject as Physics that requires understanding and imaginations, it’s important to have multiple resources so that the student can understand the topics better. Personally, I found the playlists useful because I felt like I was briefed on the topic, so I can participate during class, or at least be on the same pace as the rest of the class so that when class discussions happen, I can gain a deeper understanding. Sir’s inputs are very helpful too in clarifying muddy points on the topics.” – Student D

During the interview, Student C has expressed her positive perception, particularly in flipping their lesson on impulse and momentum concepts. She was able to prepare for the next meeting as she has the basic idea of the topic, which has resulted in active participation in the face-to-face instruction with the researcher. Furthermore, she disclosed that she tends to research and look for other materials that would enrich her knowledge on the topic. Similarly, Student D pointed out the importance of having background knowledge on the topic so he can participate in the class and be able to clear some muddy points of the concepts. Similar results have been observed with previous studies (Anand, 2015; Limuoco, 2018; Magalong and Palomar, 2019), however, in a study conducted by Saunders and Pincas (2004), the authors found out that although a number of research respondents indicated that they favor more interactive forms of teaching, the need to have more time for independent study combined with face-to-face classes will enable them to learn and reflect more of their performance.

In relation to the students’ autonomy in learning, Table 2 presents a summary of the students’ journal responses.

Table 2. Summary of Journal Responses for Autonomy

<table>
<thead>
<tr>
<th>Common Themes</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent learner</td>
<td>17</td>
<td>56.7</td>
</tr>
<tr>
<td>Develop research skills</td>
<td>7</td>
<td>23.3</td>
</tr>
<tr>
<td>Develop initiative</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>Collaboration</td>
<td>3</td>
<td>10.0</td>
</tr>
</tbody>
</table>

It can be concluded from the table that students found the use of the different pedagogical approaches to be helpful for them to become independent learners, as reflected by a percentage score of 56.7. Common responses include: “allowed me to study at my own pace,” “provided me a more growing and thinking space,” and “made my study time flexible.” Sample journal and interview responses were:

“The main advantage for me is that we were given the opportunity to study at our own pace. Thus, we were more engaged rather than being confused or overwhelmed by all the information.” – Student E

“The technology-based activities are a big help to people who have a different pace in learning. Some people think that the class discussions are too fast, some people think it’s too slow. Personally, the technology-based activities helped me because it enables learning on my own pace and allowing me to research/study further on the concepts that are hard to understand. I am also a visual learner, so seeing the scenarios illustrated is a big help. Furthermore, it was easier to search and further study the topic because I had a lot of resources. In-class lessons have helped us to understand more deeply the lessons presented in the different activities” – Student F
"I understood the lessons well because of the given technology-based activities. With the playlists provided online, I was able to think and answer the questions well because we were given a video lecture that helped me understand more take down notes. With that, I was able to slow down the video and repeat it when I do not understand something and fast forward the video when I understand the concept. I was able to learn at my own pace." – Student G

In general, the NxGBL approach encouraged the students to think more independently because there are balanced out-of-class and in-class interactions among the learners and instructor. This results in them trying to process first the information gathered through online activities in school, at home, or after school hours. Although a number of respondents gave feedback that face-to-face interaction is also important and maybe more effective combined with NxGBL. In support of the other themes, excerpts from the interview sessions were presented as follows:

"I learned to be more independent in learning. Because we will have minimal help from the teacher once they give us our schoolwork beyond school hours, and we must learn on the lesson through researching and answer the schoolwork alone. I also learned to be more time conscious and efficient; given all the schoolwork given, I must manage them all and learn each topic substantially to avoid time wastage. I also appreciate Sir Magalong's follow up discussion on the topics" – Student I

"Since each one of us has access to technology and we are easily connected through the internet, this allows us to not depend on others that much. We have the ability to independently do research and learn on our own depending on our time and according to our own way of learning. Through the next generation of blended learning, I was able to hone my researching skills as well as my audio-visual learning capability." – Student J

"The NxGBL approach encouraged me to think and work independently on study-related tasks. The skills I have developed are researching better, not depending on others, and many more. It helped me grow as an individual. I wish to have the same kind of activities as other lessons as well." – Student K

Parallel results were also observed in the works of various research studies (Ossiannilsson et al. 2016; Trestinín, 2018), which presented the increasing demands for new digital learning and educational environments and their integration with the social context. Such learning spaces can potentially promote community building and enhance collaborative knowledge, which would result in positive effects on students' learning outcomes. Furthermore, interactivity, personalization, flexibility, inclusion, and taking ownership of one's learning spaces are essential indicators of the success and quality of learning from the students' perspective (Ossiannilsson et al. 2016).

Students' Conceptual Understanding

To determine whether the difference between the pretest and posttest scores is significant, the researcher utilized the t-test for dependent means and Cohen's d. The results are shown below.

Table 3. Results of Paired Samples Test on Students' Conceptual Understanding

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>MD</th>
<th>SD</th>
<th>t-crit</th>
<th>p</th>
<th>Cohen's d</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMCS</td>
<td>4.57</td>
<td>12.60</td>
<td>8.033</td>
<td>4.406</td>
<td>9.987</td>
<td>1.699</td>
<td>.000</td>
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</table>

Table 3 shows that the p-value is lesser than 0.05 alpha level as well as the computed t-value of 9.987 which is greater than the critical value of 1.699; thus, there is a significant difference between the pretest and posttest performance of the group employing the different pedagogical approaches such as blended, flipped and personalized learning. As regards to the posttest, an increase in the overall mean score was shown in the obtained value of 12.60 out of 2.5 items. Although the mean score was not relatively high and only reached half of the total number of items, a significant increase was still attained. The low pretest result of 4.57 was further supported by a study conducted by Hestenes and Savinainen (as cited in Pantig, 2013), which reported that physics students are expected to have a relatively low performance at the beginning of the course. The effect size of 1.823 indicated a large effect on the implementation of the different technology-based tasks on the students' conceptual understanding of physics concepts. The results suggested that employing the NxGBL approach in physics classes is claimed to be a potential method in increasing students' achievement.

Nonetheless, the scores indicated that the method used in this study had positive effects on the conceptual understanding of students in energy and momentum topics. The same results were also reported from a variety of previous researchers and reports (Cheong et al. 2016a; Ossiannilsson et al. 2016b; Trestinín, 2018a; Phipps et al. 2018b) which have supported the effectiveness of using technology-rich
instructions in an NxGBL environment.

Conclusions

This study aimed to explore students’ perceptions and conceptual understanding in studying energy and momentum concepts using the NxGBL approach. Results confirmed that the use of the different educational approaches such as blended, flipped, and personalized learning has positive impacts on the students’ performance, particularly on how these helped them understand the lesson and encouraged them to study at their own pace. Furthermore, technology-enriched activities have encouraged to expand the information they have learned already in class, and allowed them to receive immediate feedback online, provided an opportunity to review contents and experienced flexibility and self-regulated learning. Journal and interview responses revealed that most of the participants claimed that lessons presented using the approach have encouraged them to think on their own and have expressed their positivity toward the utilization of this approach to other topics as well. The use of the available online platforms and tools as a result of maximizing LMSs suggests desirable and positive effects on the students’ perceptions and conceptual understanding. In addition, this recent trend in instruction realizes possible classroom dynamics and pedagogies by providing a digital learning environment that may potentially draw additional learning techniques to support our learners. However, one common response observed was the importance of holding in-class interaction with the teacher as students get to clarify unclear concepts presented online inside and outside class. Hence, the importance of holding synthesis sessions with the instructor plays an essential aspect to make this approach effective. Although the availability of technology tools and infrastructure may pose a problem among schools without an internet connection, the success of employing Next Generation Blended Learning (NxGBL) approach in this study may provide a baseline in helping the 21st-century learners to learn better while targeting the set of skills they are expected to possess.

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