

## Research Article

# ENHANCING STUDENTS' LEAST LEARNED COMPETENCIES IN BASIC CALCULUS THROUGH VODCAST

\* Roberto G. Sagge, Jr. and Johnlex L. Divinagracia

West Visayas State University, College of Education, Philippines.

Received 09<sup>th</sup> December 2022; Accepted 10<sup>th</sup> January 2023; Published online 20<sup>th</sup> February 2023

### ABSTRACT

In order to help educators and decision-makers as we continue to fight the Covid-19 pandemic, the Department of Education and the United Nations Educational, Scientific, and Cultural Organization have created a number of distance learning strategies and resources. One method is what we refer to as modular learning, specifically vodcast. Vodcast is a versatile teaching tool that can be incorporated into different lessons to aid and direct students and give them a greater understanding of what they must learn. The objective of this research was to produce a vodcast that would act as a resource for teaching basic calculus. As statistical tools, the mean and standard deviation were used. The research's findings showed that the least-learnable skills were "solve problems involving areas of plane regions," "illustrate the limit of a function using a table of values and the function's graph," "compute the limits of exponential, logarithmic, and trigonometric functions using a table of values and the functions' graphs," "illustrate the tangent line to the graph of a function at a given point," and "compute the definite integral of a function using the substitution rule". The developed vodcast was uploaded to a site and can be accessed at <https://sites.google.com/wvsu.edu.ph/basic-calculus/home>. According to the study's conclusions, vodcast has succeeded in addressing the needs of 21st-century students by being flexible, innovative, entertaining, and useful. This will make it simpler for students to gain knowledge through vodcast and be ready for class. Thus, vodcast is recommended for use by teachers as vodcasts can help and guide students and give them a better knowledge of what they must learn in Basic Calculus.

**Keywords:** Basic Calculus, vodcast, least learned competencies.

### INTRODUCTION

Teachers must use technology into the classroom in order to properly engage and educate learners of this generation (Sagge&Bacio, 2023). Information and Communication Technology increased learner learning and teaching approaches in studies worldwide. Incorporating technology into the curriculum significantly and positively influences learner accomplishment. This is based on a report published by Japan's National Institute of Multimedia Education made the findings (Linways Team, 2017). According to Georgina and Hosford (2009), Palak and Walls (2009), Marable and Valentine (2006), and others, learning is accompanied by activities that draw students' attention and pique their interest in long-term and meaningful learning. It allows learners to have a more enjoyable learning experience. It can augment, enrich, and transform what learners learn in school. The widespread use of technical structures like multimedia and the Internet in course activities is essential. The Department of Education is incorporating ICT into its system regularly. Remote locations in the region are being visited to ensure no island is left behind in technology. Learners are no longer completely reliant on complex text for learning as Philippine education embraces technology (Crisolo, 2018). The way we use technology has fundamentally revolutionized how we live our lives. Educators need to instill these skills in learners to be ready to enter the workforce after finishing school. Learners and teachers can see the advantages of technology in the classroom directly. Teachers and learners are embracing and incorporating technology in the classroom (Cox, 2017). The widespread adoption of technology has changed how students and teachers learn and teach. While students shape their own learning utilizing the media and digital

tools of today, teachers learn how to teach using emerging technologies. According to Dindar, Eristi, and Kurt's (2012) research, teachers are open to integrating technology into their lessons. But it goes without saying that they'll need continued support. Lack of staff and sub-structure may be to account for teachers' failure to effectively use the newest technology tools in their classrooms. The Department of Education (DepEd) and the United Nations Educational, Scientific, and Cultural Organization (UNESCO) have created several distant learning strategies and resources to aid educators and decision-makers as we continue to combat the Covid -19 pandemic. One of the ways is what we call Modular Learning. A distant learning strategy is a learning delivery modality in which contact occurs between a teacher and learners physically separated during teaching. Teachers can provide lessons other than the typical face-to-face format. DepEd's printed modular learning system (SLMs) was rolled out across the school year. Learners will receive four sets of SLMs over the academic year. Their teachers will give the material once a quarter rather than be handed out to learners. A vodcast is a 10 to 15-minute e-learning platform with no more than one or two learning principles, according to the University of Nebraska Medical Center. It integrates a variety of instructional and evaluation technologies, including social media, video clips, direct instruction, and gaming components. Vodcast means that learning can now be done using tablets, PC'S, or Smartphone's. According to a survey, the majority of students at state colleges and universities in the Caraga region "are motivated to employ technology in the classroom for quality performance, reinforcing the premise that using technology helps increase learning-related classroom activities". Learners' eagerness to incorporate new technology into their studies may result in classroom disturbances, considered adverse effects. EdTech in the classroom aids learners in their preparation for the digital era. Subjects that are hard to teach can be more interesting through virtual classrooms, videos, and tablets. By introducing technology into

the classroom, teachers provide learners with the skills needed to succeed (Bhati&Gorra, 2016). Each subject covered in the K–12 curriculum has the potential to be included into ICT in education. One of the subjects taught in the K–12 curricula is basic calculus. Basic Calculus is a specialist subject for STEM (Science, Technology, Engineering, and Mathematics) majors. By combining trigonometric, exponential, logarithmic, and algebraic functions into a single variable, it seeks to assist students in recognizing a function's limit, differentiating between them, and recognizing the limits of various functions. Students should be able to create and solve issues involving continuity, extreme values, related rates, population models, and areas of planar regions after completing the course (Grade 11 Curriculum Guide, 2016). Learners' understanding of Algebra and Trigonometry is required for Basic Calculus. Tarmizi (2010) investigated learners' performance in solving Calculus problems. Some learners may need more assistance, such as additional tutorial sessions to clarify their confusion. Can the teaching practice be improved if the current material is an vodcast? Thus, the researcher decided to develop an vodcast to address the least learned competencies in Basic Calculus.

### Description of the Issue.

The objective of this study was to create a vodcast for use as Basic Calculus instructional material. It specifically aimed to address the following:

1. What are the top five (5) Basic Calculus competencies that students in Grade 12 STEM least learned?
2. What educational resources and its features may be developed to address the STEM students in Grade 12 who have the least learned competencies in Basic Calculus?
3. What is the degree of acceptability of the created vodcast as judged by experts and learners in terms of (a) Learning Objectives; (b) Content; (c) Organization and Presentation; (d) Format and Design; (e) Learning Activities; and (f) Assessment?

## RESEARCH DESIGN AND METHODOLOGY

Design research was done because the study's goal was to create and evaluate vodcast as a teaching tool for the classroom. Design research has two basic goals: knowledge growth and problem solutions, and it focuses on challenges with education in realistic circumstances. Analysis, design, and assessment are the three main phases of design research, and each one may be repeated numerous times (McKenney *et al.*, 2012). Design study is intriguing because it develops a solution to an issue that meets immediate demands while also generating knowledge that can be used in the future. It might give academics and practitioners the chance to develop interventions, theories, and products that have been tried out in the real world and shown to be effective.

### Research Participants

**Learners:** Twenty-seven (27) purposefully selected STEM students from a school in Dumangas were included in the study for the assessment of the least learned lessons. These learners were chosen from a section of a school in Dumangas. On the other hand, all the Grade 12 STEM learners who were not selected in the assessment of least learned lessons became participants for the pilot testing of the instrument. The learners in that sections were also heterogeneously grouped.

**Experts:** Six experts were specifically picked to assess the acceptability of the created vodcast. They had to meet two requirements in order to be included in the study: (1) they had to be

experts in either educational technology, information technology (IT), English, curriculum development, or instructional materials development, and (2) they had to be teachers of basic calculus in senior high school.

### Data Gathering Instruments

In order to evaluate the learners' least-learned Basic Calculus competencies, the researcher created a test specifically for this study. A questionnaire for gauging learner and expert acceptance of the developed vodcast was utilized; it was adapted from Nabayra's (2019) surveys. These research instruments were subjected to face and content validation by different experts based on the nature of the research instrument and were pilot tested for reliability purposes and got a reliability score of 0.96. The pilot test was done by the researcher, with the help of the Basic Calculus teacher.

### Assessment of Least Learned Competencies in Basic Calculus:

Before creating the exam items, a table of requirements was created to track the Grade 12 STEM students' least-learned skills. Common concepts or teachings from all courses taking the Basic Calculus made up the test. The Most Essential Learning Competencies in Basic Calculus from the DepEd were the basis for the questions. The exam was an objective multiple-choice examination with 75 items. The items in the test were subjected to face and content validation by three experts from Dumangas National High School, two Mathematics experts, and one English expert and revised based on their comments and suggestions. After revision, the test for the pilot test was prepared and finalized. After finalizing the test, the test was pilot tested on 25 Grade 12 STEM-Neon learners of DNHS during the second semester of SY 2021-2022. The researcher wanted to administer the pilot test to as many respondents as possible, but these were the only learners who gave their consent and took the pilot test. After the pilot test of this instrument, item analysis and a reliability test were done. The researcher-made test's internal reliability was examined using Kuder-Richardson 20, or KR 20, and it produced an acceptable value of 0.78. The final exam consisted of 50 multiple-choice questions.

**Learners' and experts' evaluation questionnaire:** The 30-item Likert-style checklist serves as the vodcast evaluation questionnaire. This tool, which includes five statements for each of the six categories—Learning Objectives, Content, Organization and Presentation, Format and Design, Learning Activities, and Assessment—was used to assess the acceptance of the vodcast. The instrument was completed by both experts and students. This survey has undergone item analysis, a reliability test, and expert validation in addition to pilot testing. The researcher used Cronbach Alpha as its test for Reliability and yields a value of 0.96 which is an acceptable value. Three experts reviewed the evaluation questionnaire to ensure its face and content validity. These items were based on the evaluation forms of Nabayra (2019). Each participant was asked to check the appropriate column for their response. All the statements found in the evaluation questionnaire are positive statements.

### Ethical Considerations

The investigation was conducted ethically based on the American Psychological Association (APA) 7th Generation guidelines. The volunteers in this study were not harmed in any way. Furthermore, ethical norms such as privacy and confidentiality were maintained when performing ethical research. In conducting the study, the researcher adhered to the following ethical norms: (1) Permission to conduct the study to the Grade 12 STEM learners was solicited from

the respective principals; (2) The participants were assured by the researcher that they would not be harmed as a result of their participation in the study; (3) The researcher upheld the participants' right to self-determination if they refused to answer the questions or were uncomfortable; (4) The learners' anonymity was protected, and their privacy was maintained.

### Research Procedure

Prior to compiling the necessary data, the researcher obtained approval to carry out the study from the principals of the two high schools whose students were involved in it.

**Phase 1:** In the Analysis stage, the researcher's goal is to determine the least learned competencies of the Grade 12 STEM learners in Basic Calculus using a test made by the researcher. The test was composed of 50 items of multiple-choice test that covered all the 33 competencies in the curriculum guide of Basic Calculus. Experts validated the test, especially instructors who teach Senior High School Basic Calculus. Following that, changes were made in response to the validators' comments and suggestions. The 66-item validated test was then pilot tested. After pilot testing, answer sheets were checked, tallied using Microsoft Excel, and undergone item analysis to know the items that will be retained, revised, or deleted. A reliability test was also conducted. Following these procedures, the test created by the researcher was reduced to a 50-item test.

The researcher sent a letter to the different school principals requesting their approval before distributing the test. Then it was administered to students in the second semester of SY 2021-2022.

Following the test, the least learned competencies in Basic Calculus among the Grade 12 STEM students were determined using frequency count and percentage. Additionally, they covered every competency based on the Basic Calculus Most Essential Learning Competencies (MELCs).

**Phase 2:** The vodcast's format and outline were developed during the design phase. This structure was adopted from the Nabayra (2019) study. Based on information obtained throughout the Analysis stage and the MELC of Basic Calculus, this outline was created. It acts as a roadmap for the vodcast's development as it covers the least-learned Basic Calculus competences, the components of the vodcast, and its distinctive features. The vodcast's format also includes essential components: the title, learning objectives, overview, discussion, checkpoint, and key to correction—two separate features and references. Activity sheets and answer keys were also provided, which the learners answered. The created vodcast for this research included the following sections: title, goals, overview, explanation of the material, self-check exam and evaluation activities, answer key, and references.

**Phase 3:** Based on the format and framework created in the Design stage, the researcher created the vodcast during this phase. The Analysis stage, which was the least learned competency in Basic Calculus, provided the basis for the knowledge used in the vodcast's content. In addition, the vodcast was created using Microsoft PowerPoint 2019. The template to be used in making the presentation was downloaded from canva.com. In addition, four experts validated the vodcast for the first time at this stage: a Pre-calculus teacher, two IT expert/educational technology experts, and an English expert. The original plan was that the vodcast would be a video made from PowerPoint Presentation, but the validators suggested that the vodcast must be uploaded to the web. A site was then created where the PowerPoint presentations were uploaded. The site can be accessed through <https://sites.google.com/wvsu.edu.ph/basic-calculus/home>.

**Phase 4:** After the implementation, the learners were asked to accomplish the evaluation questionnaire to assess the acceptability of the vodcast. Two teachers of the subject Basic Calculus and the STEM learners of DNHS and BNNCHS evaluated the acceptability of the vodcast after the tryout. In addition, using the same assessment form as the teacher implementers, four experts were asked to assess the acceptability of the vodcast. They were allowed to watch the created vodcast in order to assess it. The experts' suggestions and comments were also considered in the revisions of the vodcast. The experiences of the teachers and the learners were also assessed using the researcher-made interview questionnaire.

## RESULTS AND DISCUSSION

### Least Learned Competencies

Table 1 shows the five least learned competencies of Grade 12 STEM learners in Basic Calculus. Solve problems involving areas of plane regions, illustrate a function's limit using a table of values and the function's graph, compute the limits of exponential, logarithmic, and trigonometric functions using tables of values and graphs of the functions, illustrate the tangent line to a function's graph at a given point, and compute the definite integral of a function using the substitution are the least-learned competence in Basic Calculus. Thus, there is a need to address this by providing instructional materials so that learners can be helped to address the competencies expected from them (Sagge & Espiritu 2023; Sagge&Bacio, 2022). The result of the study was supported by the findings of Bacio and Sagge (2022a) that the least mastered competencies show that some students still have low mastery of specific competencies, even though they have already taken the subject. The students' learning may be hampered by this poor retention.

**Table 1: Least Learned Competencies in Basic Calculus**

Competencies	%	Rank
1. Solve problems involving areas of plane regions	11%	1
2. Illustrate a function's limit using a table of values and the function's graph	19%	3.5
3. Compute the limits of exponential, logarithmic, and trigonometric functions using tables of values and graphs of the functions	19%	3.5
4. Illustrate the tangent line to the graph of a function at a given point	19%	3.5
5. Compute the definite integral of a function using the substitution	19%	3.5

### Developed Vodcast in Basic Calculus

The findings indicate that the students have less understanding of the subject matter. As a result, the researchers created vodcast videos to address the competencies that were the least mastered. According to Cables's study from 2022, teachers should offer contextualized instructional resources to their pupils in order to address the skills they have the least mastery of. Due to the fact that most textbooks on the market are authored by foreign authors and their subject matter is inappropriate for Filipino students, the new curriculum for teacher education, and the need to improve the teaching abilities required for the K-12 curriculum, contextualization is vital (Bacio&Sagge, 2019b). The study Nabayra (2020) revealed that respondents thought the e-module was very helpful. As a result, the generated e-module is valuable and may be used as instructional material in a flipped classroom approach, allowing students to learn at their own convenience.

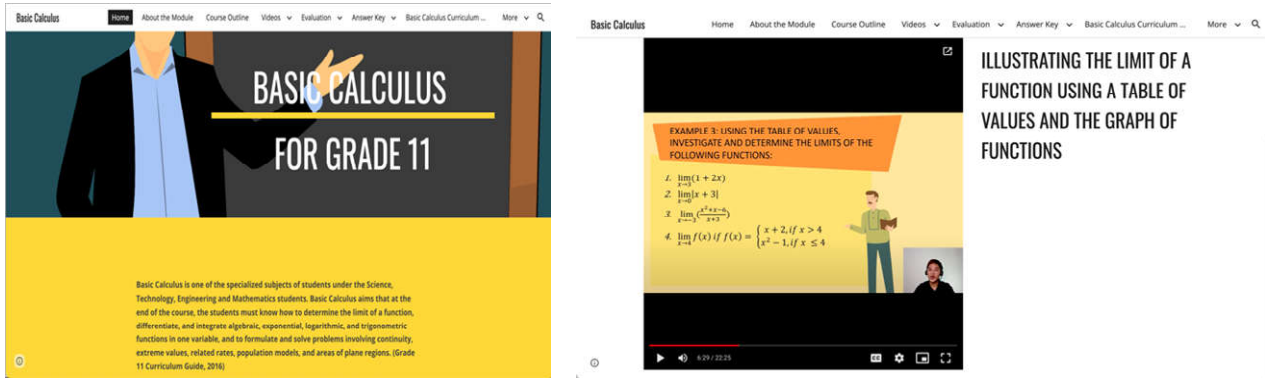


Figure 1. Sample Vodcast Video in Basic Calculus

**Learners’ and Experts’ Acceptability Evaluation of the Vodcast**

Table 2 shows the overall acceptability of the vodcast as evaluated by learners and experts. The vodcast has an overall rating of “highly acceptable.” This shows that the vodcast has excellently met the standards, and no revision is needed. This finding is supported by Bacio and Sagge’s research (2022b), which discovered that instructional material can be suitable for its intended users if its goals, content, activities, and evaluation are adequate. In general, the overall rating of the learners in terms of overall acceptability was “highly acceptable,” and the experts had an overall rating of “highly acceptable.” According to the findings, the respondents concurred that the vodcast’s learning objectives, content, organization and presentation, format and design, learning activities, evaluation, and overall rating are all extremely acceptable. This suggests that the created vodcast is valuable and can be used as educational tools to support students' independent learning. The above finding was supported by several studies related to vodcast, that is using CGIM and slide text. Slide text was not created to replace the lessons that teachers will prepare, but rather to supplement them and suggest uniformity of instructions. It may give the information, images, and tasks that are essential for grasping the concepts (Sagge&Bacio, 2019a). Additionally, according to Bacio and Sagge's (2019b) study, the developed and produced CGIM is very beneficial, as shown by the evaluators' evaluations. The outcomes also show that the CGIM was viewed favorably by the evaluators as a teaching resource for the teaching-learning process. Finally, the results of this study lend support to the conclusions of Bacio&Sagge's study (2022 a&b), which proposed that the use of slide text in the classroom could improve learning by ensuring that students pay attentive attention to the content being presented. When information is delivered to students in a dual-coded fashion using both visual and auditory clues, their comprehension of it improves.

**Table 2: Learners’ and Experts’ Acceptability Evaluation of the Vodcast Video in Basic Calculus**

	Students			Experts		
	SD	M	Description	SD	M	Description
Learning Objectives	0.62	4.49	A	0.78	4.60	HA
Content	0.58	4.55	HA	0.46	4.73	HA
Organization and Presentation	0.59	4.54	HA	0.5	4.63	HA
Format and Design	0.61	4.50	HA	0.38	4.77	HA
Learning Activities	0.6	4.48	HA	0.63	4.57	HA
Assessment	0.56	4.54	HA	0.35	4.80	HA
Overall Rating	0.59	4.51	HA	0.52	4.68	HA

**CONCLUSIONS**

Based on the findings, the following conclusions were drawn:

1. Some learners still struggle in the subject of Basic Calculus, as seen in their least learned competencies. Thus, there is a need to review. Teachers should give attention to the least mastered competencies because when the learners proceed to college with a degree related to STEM, they are expected to have learned those competencies.
2. The developed vodcast is worthy and can serve as educational resources to help learners learn at their own pace. Thus, the developed vodcast is fitted to help learners quickly learn Basic Calculus concepts.

3. The vodcast accomplished its goal of meeting the needs of 21st-century learners for technology-enhanced educational tools that are adaptable, creative, engaging, and useful, which would facilitate their building of knowledge through videos and coming to class prepared.

**RECOMMENDATIONS**

1. Education administrators may develop programs like pedagogy and instructional materials design training for teachers, as well as efforts like instructional materials development. These components are essential for improving students' learning and success. The school can develop training sessions and seminars using the institution's curriculum planners and designers, especially in regards to incorporating technology into teaching through a creative approach and instructional materials.

2. To include technology into the teaching and learning process, policymakers may look into whether instructional materials are appropriate for the level and demands of learners in this modern era.
3. In this technologically advanced educational environment, textbook authors may think about adding vodcasts in the form of videos as supplemental materials in addition to the textbooks they create to aid students in learning more efficiently.
4. Teachers are encouraged to generate unique vodcasts for use in the classroom. They may use technology-based educational tools and tactics to give students engaging and meaningful experiences, especially if they are high school students. The results of this study's findings could be put to use by other educators.
5. The primary beneficiaries of the study are the students, who are not restricted to learning within the four walls of the classroom but may instead explore different teaching strategies, such as watching recordings of lectures at home while still in school. They can use technology, develop their learning styles, and improve their study habits to learn mathematics more effectively and quickly. The vodcast produced as a consequence of this research can also be used as a reference for Basic Calculus.

## REFERENCES

- Bacio, S., & Sagge, R. (2019b). Development and production of computer-generated instructional materials for college geometry. *Journal of Physics: Conference Series*, 1254, 012040. <https://iopscience.iop.org/article/10.1088/1742-6596/1254/1/012040>
- Bacio, Jr., S. P., & Sagge, Jr, R. G. (2022b). Evaluation of the Developed and Produced Computer Generated Instructional Materials (CGIM) for College Geometry. *International Journal of Multidisciplinary: Applied Business and Education Research*, 3(11), 2329-2342. <https://doi.org/10.11594/ijmaber.03.11.19>
- Bacio Jr, S. P., & Sagge Jr, R. G. (2022a). Development and Evaluation of an Instructional Package for Komunikasyon at Pananaliksik sa Wika at Kulturang Pilipino. *Journal of Positive School Psychology*, 6(3), 3010-3027. <https://www.journalppw.com/index.php/jpsp/article/view/2083>
- Bacio, Jr., S. P., & Sagge, Jr, R. G. (2022). Evaluation of the Developed and Produced Computer Generated Instructional Materials (CGIM) for College Geometry. *International Journal of Multidisciplinary: Applied Business and Education Research*, 3(11), 2329-2342. <https://doi.org/10.11594/ijmaber.03.11.19>
- Cabiles, N.V. (2022). Exploring the Development Process and Appropriateness of a Competency-based Instructional Materials Package in Pagbasa at Pagsusuri ng Iba'tbang Teksto Tungos sa Pananaliksik. *Asia Pacific Journal Educational Perspective* Vol. 9 (1), 8-17. <https://research.lpubatangas.edu.ph/wpcontent/uploads/2022/09/2-APJEP-2022-51.pdf>
- Cox, J. (2017). Benefits of technology in the classroom. Retrieved from <http://www.teachhub.com/benefits-technology-classroom>
- Crisolo, Niño A. (2018). Sharpening education through the use of information and communications technology. Retrieved from: <https://files.eric.ed.gov/fulltext/ED586949.pdf>
- Dindar, M., Eristi, S., Kurt, A. (2012). Teachers' Views about Effective Use of Technology in Classrooms. Retrieved from: <https://files.eric.ed.gov/fulltext/ED537802.pdf>
- Georgina, D. A., & Hosford, C. C (2009). Higher education faculty perceptions on technology integration and training. *Teaching and Teacher Education*, 2.
- Linways Team. (2017). ICT Enable Education: The alchemy of mixing technology and education. Retrieved from: <https://stories.linways.in/ict-enabled-education-d190bcc91bf0>
- Marable, E.D., & Valentine, T. (2006). Optimizing computer technology integration. *Adult Basic Education*, 16(2), 99-117.
- McKenney, S. et. al. (2012). 7 Things You Should Know About Educational Design Research. Retrieved from: <https://library.educase.edu/resources/2012/8/7-things-you-should-know-about-educational-design-research>
- Nabayra, J. (2019). Vodcast as a Tool for Flipped Classroom. (Unpublished master's thesis). West Visayas State University, Iloilo City, Philippines.
- Nabayra, J. (2020). Video-Based E-module for Mathematics in Nature and Students' Learning Experiences in a Flipped Classroom. *Journal of Science and Mathematics Education in Southeast Asia*, 43. <http://myjms.mohe.gov.my/index.php/jsmesea/article/view/8813>
- Palak, D., & Walls, T. R. (2009). Teachers' beliefs and technology practices: A Mixed-methods
- Sagge, R., & Bacio, S. (2019a). Students' competence in college geometry: Basis for development of computer-generated instructional materials. *Journal of Science and Mathematics Education in Southeast Asia*, 42. [http://www.recsam.edu.my/sub\\_JSMEESEA/index.php/journals-2010-2019/2019](http://www.recsam.edu.my/sub_JSMEESEA/index.php/journals-2010-2019/2019)
- Sagge, R., & Bacio, S. (2023). Improving Students' Achievement, Habits of Mind, and Problem-Solving Skills through Computer Generated Instructional Materials (CGIM). *International Journal of Innovation Scientific Research and Review*, 5(1), 3825-3831. <http://www.journalijisr.com/sites/default/files/issues-pdf/IJSRR-1107.pdf>
- Sagge, R. J., & Espiritu, E. E. (2023). Project DESMOS: Development and Evaluation of Self-directed Module in Statistics and Probability. *International Journal of Multidisciplinary: Applied Business and Education Research*, 4(1), 48-56. <https://doi.org/10.11594/ijmaber.04.01.06>
- Tarmizi, R. A. (2010). Visualizing Learners' Difficulties in Learning Calculus. Retrieved from: <https://www.sciencedirect.com/science/article/pii/S1877042810021580>

\*\*\*\*\*