

Blended learning delivery modality for learning science subjects in STEM track curriculum of senior high schools

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Received: 30 April 2022

Available Online: 14 May 2022

Revised: 7 May 2022

DOI: 10.5861/ijrse.2022.319

Accepted: 14 May 2022

ISSN: 2243-7703

Online ISSN: 2243-7711

OPEN ACCESS



Abstract

This position paper is focused on what is being believed as the most appropriate learning delivery modality for learning Science subjects in Senior High Schools with STEM Curriculum; blended learning delivery modality (a combination of MDL and ODL when face to face instruction is not allowed in a school) over pure modular distance learning. The author interviewed five (5) Senior High School Students from three (3) Senior High Schools (coming from the three divisions of Caraga Region) offering STEM Track who were randomly chosen. Two open ended questions were sent to the respondents thru the help of their Science Supervisors. The first question asked about the challenges that they encountered while learning STEM Science Subjects this pandemic and the second question asked about their preferred learning modality. The paper reveals the struggles or the challenges of the students in which they emphasized that self-learning modules are not sufficient for them to understand the concepts in STEM Science subjects. They need the guidance or scaffolding from the teachers. Likewise, this shows the learning modalities which they preferred so as to make it easy for the them to learn the concepts in higher sciences in the STEM Track. The respondents preferred blended learning modality (a combination of modular distance learning and online distance learning modality) to have deeper understanding of concepts in science as well as proper acquisition of basic and integrated process skills. With MDL, learners can be made to work on the activities and other tasks in the modules, then with ODL, difficult concepts can be clarified through further explanations from the teacher. Hence, lessons from the modules can be enhanced by the teacher through ODL.

Keywords: modular distance learning modality, blended learning, online distance learning, STEM track, challenges

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1. Introduction

In order for the future generations to become successful in their chosen careers, Science, Technology, Engineering and Mathematics (STEM) education provides them enough preparation. With STEM-based education, learners are taught more than science and mathematics concepts-because its focus is on hands-on learning with real- world applications. This hands-on learning helps develop various skills including creativity and 21st century skills ([https://www.invent.org/blog/trends_stem/value-stem- education](https://www.invent.org/blog/trends_stem/value-stem-education)).

One of the academic tracks offered by Senior High Schools in the Philippines is the STEM Track offering highly specialized science subjects like General Biology 1 and 2, General Physics 1 and 2, General Chemistry 1 and 2, Earth Science, Earth and Life Science, and many others. The functions and outcomes of the education system were greatly affected when COVID-19 pandemic happened. This scenario is true across the world and affects all teachers and learners in different degrees depending on many factors like age, family background, access to some “substitute” educational opportunities during pandemic (Garcia & Weiss, 2020).

With the pandemic, the Department of Education introduced different learning delivery modalities to continue education as strongly emphasized by Secretary Leonor Briones (Malipo, 2020). Modular Distance Learning (MDL), Online Distance Learning (ODL) and TV-Based/Radio-Based Instruction are included in these learning delivery modalities. Around 85% of schools in Caraga Region adopted Modular Distance Learning (MDL) using Central Office (CO) initiated Self-Learning Modules (SLMs) and Region or Division initiated Learning Activity Sheets (LAS) as supplementary materials. This modality was adopted by most schools because it is the most feasible one and the materials are available. However, during the early part of SY 2020-2021, schools nationwide were struggling because the chosen teacher writers were developing yet the modules and after the development, the modules underwent series of validation by the experts before they were used in the field.

When the modules were not available yet, Caraga region took an initiative to develop learning activity sheets (LAS) which underwent series of validation also by the content experts and by the Education Program Supervisors. These Learning Activity Sheets (LAS) were used by the different learning areas while waiting for the self-learning modules (SLMs) from the Central Office (CO). Being an Education Program Supervisor in Science, the author has observed that both teachers and learners have some struggles and challenges in Modular Distance learning. On the part of the teachers, they find it difficult to assist their learners if they experience difficulties with the lessons. Text messaging, chatting and calling are not enough. In addition to, significant authentic assessments and application of science concepts are difficult to do due to the absence of laboratory activities or experiments. On the part of the learners, they are struggling because the topics in STEM sciences are very difficult to understand by themselves, they need the teachers to assist them.

To give more weight to the position of the author, she interviewed five (5) Senior High Students from three Secondary Schools (of the three divisions of Caraga Region) offering STEM Track who were randomly chosen. The study was conducted last November 2021. Two (2) open- ended questions were sent to them through the help of their Science Supervisors. These open-ended questions were asking about the challenges that they encountered while learning STEM Science Subjects using MDL and whether they prefer Blended Learning Modality (combination of Modular Distance Learning (MDL) and Online Distance Learning (ODL) over pure Modular Distance Learning Modality.

The author firmly believes that Blended Learning Modality (a combination of MDL and ODL) is the best option to deliver scientific knowledge or concepts to the learners of the STEM Track

curriculum since the concepts expressed in the SLMs can be understood better by the learners as the teacher conducts live discussion thru synchronous engagements via google meet or zoom platforms. Besides, virtual experiments can also be done using virtual laboratory to demonstrate basic process skills and integrated process skills during online classes or the teacher himself can demonstrate concepts during online classes.

2. Related Literature

2.1 On science education/STEM education

Society gives so much value to science because the application of scientific knowledge helps satisfy basic human needs and improve living standards. Science is also considered as a driving force towards economic growth which is seen as a return on investment for public funding (Rull, 2014). According to Timonen (2020), science education promotes scientific literacy and responsible citizenship. Scientific literacy means an individual's scientific knowledge and its uses. This gives an individual the capacity to understand the scientific processes and make it possible to apply evidenced-based knowledge across a broad range of issues that require individual and collective action like responding to COVID-19 and climate change, and many others.

On the other hand, Secretary Dela Peña of the Department of Science and Technology (DOST) uttered that Science, Technology, Engineering and Mathematics are intertwining disciplines when they are applied in the real world. STEM curriculum differs with the other strands and tracks in Senior High School because it focuses on advanced concepts and topics (Geminiano, 2018). Graduates of STEM track can become a doctor, engineer, dentist, chemist, nutritionist, etc. More students are attracted to Science and Technology courses. Hence, they prefer to stay in the STEM Track.

2.2 Modular distance learning modality

In Modular Distance Learning modality, individualized instruction is utilized. It allows learners to use self-learning modules (SLMs) in print or digital format/electronic copy, whichever is applicable in the context of the learner together with other learning resources like textbooks, learner's materials, teaching guides, learning activity sheets, study guides, and others. The progress of the learners should be monitored by the teachers. Assistance or help can be asked from their teachers thru e-mail, telephone, text message/instant messaging, etc. Home visitation may be done for possible interventions or remediation. Parents or any member of the family can assist the learners (Llego, 2021). Figuerres as cited by Trovela (2021), mentioned that a module is a self-contained, independent unit of instruction prepared for the purpose of achieving specific tasks or specific learning objectives. Module is self-directing because it includes instructions on how the different tasks will be done by the learners. Also, the list of materials and other resources are included to accompany the text of the module. Classroom instruction which uses modules is described as self-pacing in which the pupils progress through the learning tasks at their own rate.

2.3 On the challenges of using modular distance learning modality

Castroverde and Alcala (2021), pointed out in their study that COVID-19 does not only threaten the lives of people around the world, but it also affects the various sectors of society. Education sector is one of these which strive to cope with the challenges of the pandemic. In the Philippines, public secondary schools implemented modular distance learning. According to the survey conducted by the Department of Education, it is the most preferred modality by parents especially in rural areas where gadgets are not available at home and internet connection is not accessible for online learning. With modular distance learning modality, a lot of challenges were encountered by both the teachers and learners of Senior High School STEM Track.

When the researcher asked the respondents question like, "What are the challenges that you encountered while learning STEM science subjects this pandemic?"

One respondent answered,

“One of the challenges I have encountered in learning STEM science subjects was understanding complex topics all by myself”. “Self-learning modules do not appear to be sufficient for me to comprehend such difficult and complicated subject” (MG F. Javillona, personal communication, November 11, 2021).

Dangle and Sumaong (2020) revealed in their study that there are struggles associated with the use of modular distance learning. These include parents’ lack of knowledge to academically guide their children, students struggle with self-studying. Indeed, the students struggle in answering the activities found in the module because their parents cannot assist them and there is no teacher who can assist them. For the Senior HS students in the STEM Track, the more that they will struggle especially that the subjects are highly specialized.

On the other hand, another student says *“There are times that I left some topics or questions unexplained”* (B. C. Gemao, personal communication, November 11, 2021). According to Castroverde and Alcala (2021), there are students who submit their modules without answer which means that they are not interested in the process of learning. This could happen especially if the activity is very difficult. In addition to, another response from the student participants were

“Not all learners are self-taught and most of them really need the guidance and scaffolding from the teachers. “I need someone (teacher) to explain to me the lessons for my better understanding and for me to really get the lessons” (J. Tulaytay, personal communication, November 5, 2021).

“In this pandemic the challenges that I encounter while learning STEM Science subjects is the self-learning because some of the examples given in the modules are incomplete, that is why sometimes I find it difficult to understand the lessons especially in General Physics subject which is more on calculations and analysis” (G. Ravelo, personal communication, November 6, 2021).

Trovela (2021) in her study revealed that one of the challenges of modular distance learning that emerged includes learners do self-study and do not have the same level of understanding and so they struggled in studying having no physical guidance from the teacher. In addition, Anzaldo (2021) mentioned in her study that some pupils have difficulty in answering the modules without the supervision from the teacher. With the reasons above, the participants including the researcher herself are not in favor of pure Modular Distance Learning Modality for learning STEM Science subjects.

2.4 On blended learning modality (A combination of modular distance learning modality and online learning delivery modality)

According to Custodio (2020), from the viewpoint of DepEd, “blended learning” or “hybrid learning” is a combination of online distance learning and in person delivery of printed materials (self-learning modules or learning activity sheets) to the homes of the learners through the barangays for those who don’t have internet access and interactive gadgets at home. In the localities where this strategy is not possible, DepEd utilizes radio and television to broadcast lessons, materials and instructions for the learners. In DEPED, Modular Distance learning uses Self-Learning Modules (SLMs) or Learning Activity Sheets. Online learning makes it possible for synchronous or asynchronous teaching or instructions. According to Mercier et al. (2021) video telecommunication tools such as Microsoft Teams, Zoom, Skype, etc. are used in synchronous teaching with the whole class, while asynchronous teaching utilizes supporting materials to be provided to the students for self-study, sound enhanced slideshow, video capsules, book chapter reading and many others. The participants of this study who are the Senior High School students prefer Blended Learning, a combination of Modular Distance Learning and Online Learning.

They were asked with the open-ended question that says, if you are to choose, which modality would you prefer, Modular Distance Learning modality, or Blended Learning modality (a

combination of modular distance learning and online distance learning)?

One participant answered,

“I prefer Blended Learning Modality because it allows me to learn at my own pace (with modules) while still having the support of a teacher who can help speed up my learning process and/or provide more advanced materials as needed (through online synchronous engagement or asynchronous engagements)” (MG F. Javillona, personal communication, November 11, 2021).

Another participant says,

“I prefer blended learning modality because for me in blended learning modality I can understand the something unintelligible lessons because I can ask the teachers for my concerns about the lessons during online class” (J. Beltran, personal communication, November 6, 2021).

“I choose Blended Learning modality because students would have a chance to ask some questions with regard to difficult topics from the Self-learning modules or Learning Activity Sheets (J. Tulaytay, personal communication, November 5, 2021).

Moreover,

“blended learning is more engaging and the instructor can use their time efficiently to teach and help their students access additional information that is not present in the modules”, according to one participant (B. Gemao, personal communication, November 11, 2021).

“I would really choose blended learning so some difficult problems and concepts from the SLMs or LAS can be explained and examples can be given during Online Learning before the students can solve on their own” (J. Beltran, personal communication, November 6, 2021).

From the responses of the participants, it can be deduced that their preference is Blended learning modality, a combination of MDL and ODL because with MDL, they can learn at their own pace and their difficulties or issues from the topics can be clarified during Online Learning because the teachers can give further explanations or additional information about the topic.

3. Author’s arguments

When face to face instruction is not allowed in schools, the author strongly hopes that all Senior High School offering Science, Technology, Engineering and Mathematics (STEM) Track would utilize Blended Learning Modality (combination of MDL and ODL) so as to lessen the burdens or struggles of the learners while continuing their education in this pandemic. According to Stauffer (2020), blended learning uses different instructional resources and teaching methods in multiple ways. In blended learning modality (combination of MDL and ODL), the learners can set their particular schedule to accomplish the tasks in the SLMs or LAS in MDL and then during Online synchronous engagement the teachers can make follow-up whether the tasks have been accomplished.

Modular Distance Learning teaches learners the values like good time management, discipline, and experimentation and ODL teaches learners proper social interaction and patience (especially when the internet becomes unstable). Thompson (2021) pointed out that online classes foster more interactions. Students who are too shy to ask a question in front of their entire class now have the option of initiating a live, private chat with their instructor. A student who feels uncomfortable with broadcasting to the entire class can opt to mute their microphone or can disable their camera as he continues to participate in the lesson. Therefore, many values can be developed among the learners with Blended learning.

MDL is self-pacing. Learners can answer only the tasks or assessments for a particular day and they can continue in the next day. ODL can also allow learners to work at their own pace since ODL allows lessons to be

recorded where learners can have the opportunity to watch over and over again, hence, an opportunity to answer the tasks without pressures. Carrigan (2020) cited in her article that ODL allows recorded lectures with closed captioning where students can refer from time to time, and this closed captioning can help with taking notes. With MDL, learners can be made to work on the activities and other tasks in the modules, then with ODL difficult concepts can be clarified through further explanations from the teacher. Hence, lessons from the modules can be enhanced by the teacher through ODL.

4. Conclusion

Blended learning intends to optimize teacher instruction and planning time. Likewise, it provides teachers with accurate data about their learners. Aside from these, blended learning engages students, promotes deeper thinking and allows learners to learn at their own pace and to take ownership and responsibility over their duties and responsibility in school (Harris, 2017). Hence, the author hereby advocates Blended Learning as a modality to be adopted by the Senior High Schools offering STEM Track, blended learning which is a combination of MDL and ODL rather than pure Modular Distance Learning Modality. It is the preferred modality of the respondents.

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