Jurnal Penelitian dan Pembelajaran IPA JPPI
Vol.8, No.2, 2022, p. 205-226 p-ISSN 2477-1422 e-ISSN 2477-2038

# Factors for Successful Science Learning in a Flexible Mode amid Covid-19 Educational Disruption: Students' Assessment

(Received 3 May 2022; Revised 30 November 2022; Accepted 30 November 2022)

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**DOI: 10.30870/jppi.v8i2.15125**

## Abstract

Due to the educational disruption caused by the COVID-19 pandemic, educational institutions resorted to flexible learning modalities to continue the education of students and avoid learning losses. This descriptive online survey assessed different factors for successful science learning in a flexible mode utilized during the current learning setup. A total of 50 teacher education students specializing in science from the two campuses of a state university in Zambales, Philippines, responded to the researcher-crafted survey questionnaire ($\alpha$=0.971). Results of the study showed that most of the respondents are using the online asynchronous learning modality. Almost all of them are using smartphones for their flexible learning. The college students strongly agree that instructor characteristics is a primary factor for successful science learning in a flexible mode, followed by internet accessibility, administrative support, course content and design, technical support, learner characteristics, and social support. Significant differences were noted in the factors for successful science learning in a flexible mode when grouped according to the learning modality used. Furthermore, positive significant moderate to high correlations were observed among factors for successful science learning in a flexible mode. The study suggests that schools may provide instructors with training and seminars about flexible education to further enhance their content knowledge and pedagogy in science, specifically in this educational disruption. Additionally, the university may craft programs and policies that address students' concerns in the current learning setup to avoid learning losses. These programs and policies could make the current learning modality more effective, efficient, and responsive to the students' needs, and more conducive for both faculty and students. Future researchers could conduct a further study to evaluate college students' experiences in flexible learning modalities in university for the past semesters.

Keywords: Educational Disruption, Factors, Flexible Mode, Online Survey, Science Learning

## INTRODUCTION

With the current pandemic, face-to-face in-person classes are disrupted, resulting in universities and other educational institutions resorting to flexible learning modalities as a teaching method. Flexible learning refers to a collection of educational philosophies and systems that gives learners more options, convenience, and personalization to meet their learning needs, providing choices regarding how, when, and where learning happens (Joan, 2013; El Islami, Nuangchalerm, & Sjaifuddin 2018; Nuangchalerm & El Islami 2018; Parmin, Nuangchalerm, & El Islami, 2019; Parmin et al 2020; El Islami & Nuangchalerm, 2020). Flexible learning modalities are the most practical compared to other modalities as they lack restrictions regarding location, time, and study pace (Cortes, 2020).

The Commission of Higher Education (CHED) in the Philippines specified flexible learning modes that can be utilized during the pandemic educational disruption. In the article written by Magsambol (2020), three modes of flexible learning are stated; online, offline, and blended learning.

Islam et al. (2015) state that challenges in pedagogical e-learning, learning style and cultural, technological, technical training, and time management are met by higher educational institutions when e-learning is employed and implemented. Furthermore, hybrid and online classes show positive and negative experiences for the students and understanding and learning as these provide implications regarding how effective the teaching strategies are utilized (El Mansour & Mupinga, 2007).In addition, factors and challenges to the said method are present, making the use of e-learning systems and online learning a significant problem among higher educational institutions. To successfully use the said learning method, an understanding of adoption factors is needed (Almaiah et al., 2020).

Independent factors such as administrative support, course content, course design, instructor characteristics, learner characteristics, social support, and technical support affect the quality of e-learning teaching in higher education institutions utilized during the COVID-19 pandemic (Elumalai et al., 2020). In addition, Kim (2020) states that accessibility of broadband internet can compromise the quality of education among tertiary students; a majority of the class, especially synchronous remote learning, relies primarily on the internet.

In the Philippines, various studies have been conducted regarding the utilization of various modes of flexible

learning. Studies include challenges and issues in open and distance learning (Arinto, 2016), challenges college students encountered with flexible learning (Laguador, 2021), teachers' responses to challenges in conducting distance learning (Alea et al., 2020), and faculty's perception on online education (Moralista & Oducado, 2020). However, limited studies are conducted regarding students' assessment of factors for successful learning, specifically in science, in flexible mode during educational disruption. Hence, the study was conducted to assess administrative support, course content and design, instructor characteristics, learner characteristics, social support, technical support, and internet accessibility in students' successful science learning in a flexible mode utilized during this current learning setup.

**Purpose of the Study**

The study was conducted to assess the factors for students' successful science learning in a flexible mode utilized during this current learning setup.

## METHOD

**Research Design**

The researchers utilized a descriptive online survey as a research design to assess the factors for students' successful science learning in the flexible mode used during the current learning setup. The data were triangulated through an informal interview.

**Respondents**

The study respondents were 50 Bachelor of Secondary Education (BSED) major in Science students from two state university campuses in Zambales, Philippines. The respondents were chosen through quota sampling. Table 1 shows the demographic profile of the respondents.

| Profile | F *(N=50)* | % |
|---|---|---|
| *Sex* | | |
| Male | 21 | 42.00 |
| Female | 29 | 58.00 |
| *Year Level* | | |
| First Year | 16 | 32.00 |
| Second Year | 16 | 32.00 |
| Third Year | 18 | 36.00 |
| *Campus* | | |
| Campus A | 12 | 24.00 |
| Campus B | 38 | 76.00 |
| *Age* | | |
| 17-18 years old | 4 | 8.00 |
| 19-20 years old 20-24 years old | 31 | 62.00 |

| Profile | F *(N=50)* | % |
|---|---|---|
| 21 years old and above | 15 | 30.00 |
| *Family Monthly Income* | | |
| Below P10,957 | 30 | 60.00 |
| P10,957 to P21,914 | 15 | 30.00 |
| P21,914 to P43,828 | 3 | 6.00 |
| P43,828 to P76,669 | 2 | 4.00 |
| *Flexible Learning Modality Used in Science Class** | | |
| Modular Printed | 6 | 12.00 |
| Online Synchronous (Online Class) | 21 | 42.00 |
| Online Asynchronous (Google Classroom, Edmodo) | 48 | 96.00 |
| *Available Gadgets Used in Flexible Learning** | | |
| Smartphone | 49 | 98.00 |
| Tablet/Ipad | 1 | 2.00 |
| Television | 6 | 12.00 |
| Laptop Computer | 22 | 44.00 |
| Netbook | 0 | 0 |
| Desktop Computer | 1 | 2.00 |
| Others | 0 | 0 |
| *If you are using online synchronous, what video conferencing app do you use?** | | |
| Zoom | 16 | 32.00 |
| Google Meet | 46 | 92.00 |
| Facebook Messenger | 30 | 60.00 |
| None | 2 | 4.00 |
| *If you are using online asynchronous, what online platform do you use?** | | |
| Google Classroom | 48 | 96.00 |
| Edmodo | 35 | 70.00 |
| Gmail | 40 | 80.00 |
| Facebook Group | 37 | 74.00 |
| None | 1 | 2.00 |

*multiple responses

Of the 50 respondents, 42% are males, while 61% are females. Both 32% of the respondents are first-year and second-year students, and 36% are third-year students. Meanwhile, out of the 50 respondents, 24% are studying in Campus A while 76% are studying in Campus B. Furthermore, 8% of the respondents are within the age bracket of 17-18 years old, 62% are within the age bracket of 19-20 years old, and 30% are

21 years old and above. Lastly, a majority (60%) of the respondents are within the family monthly income bracket of below P10,957, 30% are in the family monthly income bracket of P10,957 to P21,914, 6% are on P21,914 to P43,828 family monthly income bracket, and 4% are in the family monthly income bracket of P43,828 to P76,669.

The majority (96%) of the respondents use online asynchronous as a flexible learning modality in science class. Meanwhile, 42% of the respondents use online synchronous, and 12% use modular printed. In addition, most of the respondents (98%) also use smartphones as gadgets for flexible learning. Also, 44% use a laptop computer, 12% use television, 2% use tablet/iPad and desktop computer, and none use a netbook as their gadget. Among respondents who are under an online synchronous mode of learning, 92% use Google Meet as a video conferencing app in the said mode of learning, 60% use Facebook Messenger, 32% use Zoom, and 4% do not use any video conferencing app. In contrast, none of the respondents uses Skype. Meanwhile, among respondents under an online asynchronous mode of learning, 96% use Google Classroom as an online platform on the said mode of learning, 80% use Gmail, 74% use Facebook Groups, 70% use Edmodo, and 2% use no online platform.

**Data Collection Tool**

The study used survey questionnaires created by the researchers, which was administered using Google Form. The survey questionnaire was content validated by experts using a 4-point Likert scale among the criteria format, readability, clarity, organization, the accuracy of the content, adequateness of the content, suitability of items, suitability to target respondents, congruence to the research objective, and objectivity of the items, resulting to means of 3.67 to 4.0. The validators also provided feedback and remarks to improve the survey questionnaire.

The Factors for Successful Science Learning amid Covid-19 (FSSL-C19) survey questionnaire comprises 35 items on a 4-point Likert Scale (scored from 1 – strongly disagree to 4 – strongly agree). The tool is divided into three parts. The first part includes the demographic profile of the respondents. The second part consists of the factors for successful science learning with five items each, namely the administrative support ($\alpha$= 0.832), course content and design ($\alpha$= 0.760), instructor characteristics ($\alpha$=0.939), learner characteristics ($\alpha$=0.886), social support ($\alpha$= 0.822), technical support ($\alpha$=0.906), and internet accessibility ($\alpha$=0.849). The overall

Cronbach alpha coefficient is 0.971, implying that the instruments had excellent internal consistency. Meanwhile, the third part includes an open-ended question regarding other factors for successful science learning in flexible mode learning during this current learning setup.

**Study Context**

The study was conducted on the two campuses of a state university in Zambales, the Philippines, for 2020-2021. The locale is a comprehensive university offering a baccalaureate degree in teacher education specializing in science. The study was conducted after a year of the ongoing COVID-19 pandemic, which the World Health Organization declared as a pandemic on March 11, 2020. The study duration was from May to June 2021.

**Data Collection**

The researchers first gathered related articles and literature to the study. With the current pandemic situation, the researchers developed survey questionnaires using Google Forms to limit physical interaction between researchers and the respondents. The researchers then asked for approval from the college of teacher education chairpersons of the two campuses of a state university in Zambales, Philippines. After seeking permission, the survey was distributed to the respondents on respective campuses included in the study using the said online platform. Data collected using Google Forms is analyzed and treated using statistical tools to assess the factors for students' successful science learning in a flexible mode utilized during this current learning setup.

**Data Analysis**

The researchers encoded, tabulated, and organized the collected data using SPSS v.25 and Microsoft Excel 2016. Frequency and percent were used to describe the profile of the respondents. The weighted mean was utilized to determine the different factors affecting students learning in science through flexible learning modalities amidst the pandemic. The qualitative interpretation is as follows: Strongly Agree (SA) 3.50 – 4.00; Agree (A) 2.50 – 3.49; Disagree (D) 1.50 – 2. 49; Strongly Disagree (SD) 1.00 – 1.49. The study also used ANOVA (Analysis of Variance) to check the significant difference in the factors for successful science learning in a flexible mode when grouped according to profile variables. Furthermore, the study also utilized Pearson-r to determine the significant relationship among the different factors for successful science learning through flexible mode. The researchers also used thematic analysis to analyze the students' responses to the open-ended questions.

## RESULTS AND DISCUSSION

### Respondents' Level of Agreement on the Different Factors in Successful Science Learning in a Flexible Mode

Table 2 shows the students' level of agreement in successful science learning in a flexible mode amid educational disruption in terms of administrative support.

Table 2 Respondents' Level of Agreement on Administrative Support in Successful Science Learning in a Flexible Mode

| Statements | M | SD | VD |
|---|---|---|---|
| 1. The university personnel (e.g., campus librarian, student affairs head, dean, program chair) should provide help and support to students in learning science suitable to the current learning setup. | 3.80 | 0.40 | SA |
| 2. The administrative staff and personnel must extend help to address problems and concerns regarding science learning. | 3.64 | 0.53 | SA |
| 3. The administration should guide science instructors to improve their teaching performance. | 3.66 | 0.63 | SA |
| 4. The school should provide digital resources which can help students in learning science remotely. | 3.66 | 0.56 | SA |
| 5. The administration must adequately support student's learning needs. | 3.68 | 0.51 | SA |
| **Weighted Mean** | **3.69** | **0.53** | **SA** |

Legend: M-Mean; SD-Standard Deviation; VD-Verbal Description; Strongly Agree (SA)

As reflected in the table, the respondents strongly agree on the role of administrative support in successful science learning in a flexible mode during educational disruption, as shown by the weighted mean of 3.69 (SD=0.53).

All statements under this factor have a verbal description of strongly agree, with a mean of 3.64 to 3.80. These include providing help among students suitable to the current learning setup (M=3.80), addressing problems and concerns regarding science learning (M=3.64), guiding science instructors to improve teaching performance (M=3.66), providing digital resources for student's remote learning (M=3.66), and supporting student's learning needs (M=3.68). The rsult implies that students primarily agree that the university administration, personnel, staff and the university itself should and must help in sufficing and supporting the learning needs of students during the pandemic. Students believe that administrative support ensures successful science learning in a flexible mode amid educational disruption in this current learning setup. It can be deduced that

students view the administrative function of the university as still vital and relevant despite studying remotely.

The results support the study of Barefield and Meyer (2013), which states that adequate and suitable support and assistance given by the administrative and the leadership is key to success in executing a new online teaching program or even changing a current program. Administrative support has been found as an essential element in the success of flexible learning, especially during the pandemic (Callinan, 2020; Pawilen, 2021; Solomo, 2022).

Table 3 shows the students' level of agreement in successful science learning in a flexible mode amid educational disruption in course content and design.

Table 3 Respondents' Level of Agreement on Course Content and Design in Successful Science Learning in a Flexible Mode

| Statements | M | SD | VD |
|---|---|---|---|
| 1. The science course syllabus should be suitable for the current learning setup. | 3.78 | 0.46 | SA |
| 2. The way the lessons are presented in science modules must be understandable by the students. | 3.76 | 0.56 | SA |
| 3. Relevant resources provided by the instructor must be self-explanatory and are easy to understand. | 3.62 | 0.57 | SA |
| 4. The tasks and science activities in class must be contextualized in the current pandemic using the current learning modality. | 3.68 | 0.55 | SA |
| 5. Course requirements crafted must be easy to accomplish given the current learning setup. | 3.62 | 0.57 | SA |
| **Weighted Mean** | **3.69** | **0.54** | **SA** |

Legend: M-Mean; SD-Standard Deviation; VD-Verbal Description; Strongly Agree (SA

As gleaned from the table, the respondents strongly agree on the role of course content and design in students' successful science learning in flexible mode, as revealed by the weighted mean of 3.69 (SD=0.54).

Every statement under course content and design shows high means, ranging from 3.62 to 3.78, which shows respondents' strong agreement. Students believe that the course syllabus in science should be suitable to the current set up of learning (M=3.78), the topics should be presented in an understandable manner (M=3.76), the provided resources should be self-explanatory and understandable (M=3.62), the activities provided must be conceptualized to the current pandemic (M=3.68), and the requirements in the science course should be easy (M=3.62). Results of the study show that students agree that the way the science topics and lessons are presented during this flexible

mode of learning and the approach manifested in the modules provided are integral. It implies that the module itself takes a significant role in achieving successful science learning among students.

The findings confirm the study of Mtebe and Raisamo in Almaiah and Alyoussef (2019), that both the acceptance of the students in the learning system and maximization of the utilized learning system tends to increase due to well-designed courses. Instructional designers carefully consider course content and design to ensure the attainment of the set learning outcomes (Huang et al., 2020; Li & Wong, 2018; Muller Werder et al., 2018). Educational institutions must continue to review and rethink the curriculum content to be aligned with the current and emerging needs of the times, specifically in the post-COVID-19 era (Rogayan et al., 2021).

Table 4 shows the students' level of agreement in successful science learning in a flexible mode amid educational disruption in terms of instructor characteristics.

Table 4 Respondents' Level of Agreement on Instructor Characteristics in Successful Science Learning in a Flexible Mode

| Statements | M | SD | VD |
|---|---|---|---|
| 1. The science instructors should be approachable and ready to provide the learning needs of the students. | 3.78 | 0.51 | SA |
| 2. The way science instructors teach in flexible learning modalities should be in an understandable manner. | 3.82 | 0.44 | SA |
| 3. Science instructors should show empathy and consider student's learning needs and capabilities. | 3.80 | 0.45 | SA |
| 4. The instructors must respond to student's questions and queries in the science course, which can help them understand the lesson well. | 3.78 | 0.46 | SA |
| 5. The teacher must implement proper online etiquette in flexible learning classes. | 3.76 | 0.48 | SA |
| **Weighted Mean** | **3.79** | **0.47** | **SA** |

Legend: M-Mean; SD-Standard Deviation; VD-Verbal Description; Strongly Agree (SA

As displayed in the table, the students strongly agree on the instructor characteristics as a factor in successful science learning in a flexible mode, recording a weighted mean of 3,79 (SD= 0.47).

The students strongly agreed upon all of the statements under the instructor characteristics factor, with means ranging from 3.76 to 3.80. Students

strongly agree that science instructors should be approachable and should provide for student's learning needs (M=3.78), teach in an understandable manner through flexible mode of learning (M=3.82), show empathy and considerate of students' learning needs (M=3.80), responsive to students' queries and questions (M=3.78), and implement proper online etiquette towards flexible classes (M=3.76). The finding suggests that despite students learning remotely and under a different mode of learning, they still need their instructors' guidance. Furthermore, the students primarily believe that the role and how the instructors teach on a flexible mode of learning during the current learning setup affect their learning. Results of the study imply that students recognize that appropriate instructor characteristics during a flexible learning mode are relevant and equate to successful learning in science.

Such a result can be related to the study of Sharma et al. (2020), which reveals that instructor characteristics lead to students' satisfaction with online learning. It also confirms the results of previous studies on the role of instructors in successfully implementing flexible learning (Denan et al., 2020; Li et al., 2022; Veletsianos, & Houlden, 2019).

Table 5 shows the students' level of agreement in successful science learning in a flexible mode amid educational disruption in terms of learners' characteristics.

Table 5 Respondents' Level of Agreement on Learners' Characteristics in Successful Science Learning in a Flexible Mode

| Statements | M | SD | VD |
|---|---|---|---|
| 1. The learners must solve complex problems in science that are important in their future in this current learning modality. | 3.54 | 0.54 | SA |
| 2. The students must learn new skills in science subjects using this current learning modality. | 3.66 | 0.52 | SA |
| 3. The students should be motivated to learn and do their activities in their science subjects. | 3.74 | 0.49 | SA |
| 4. The students should have self-initiative and self-responsibility in a flexible learning class. | 3.72 | 0.50 | SA |
| 5. The students must learn how to adapt to the flexible learning setup. | 3.64 | 0.56 | SA |
| **Weighted Mean** | **3.66** | **0.52** | **SA** |

Legend: M-Mean; SD-Standard Deviation; VD-Verbal Description; Strongly Agree (SA

The table shows that the students strongly agree on the learners' characteristics as a factor in successful science learning in a flexible mode, as shown by the weighted mean of 3.66 (SD=0.52).

The students show strong agreement on all of the statements under learners' characteristics, showing a mean of 3.54 to 3.74. Statements on the said factor include learning to solve complex and important science problems (M=3.54), learning new science skills (M=3.66), being motivated to learn and conduct activities during a flexible mode of learning (M=3.74), having self-initiative and self-responsibility (M=3.72), and learning to adapt to the current learning setup (M=3.64). The finding implies that the students recognize the need for independence and self-discipline while practicing the current learning setup. Furthermore, the students also clearly identify their role in the success of science learning during this current mode of learning. It can be deduced that students realize their overall responsibility during the implementation of the flexible mode of learning.

This affirms the findings of the study by Gorbunovs et al. (2016), which states that students' self-discipline has positive implications on the students' learning outcomes in an e-learning environment.

Table 6 shows the students' level of agreement in successful science learning in a flexible mode amid educational disruption in terms of social support.

Table 6 Respondents' Level of Agreement on Social Support in Successful Science Learning in a Flexible Mode

| Statements | M | SD | VD |
|---|---|---|---|
| 1. Parents and the most knowledgeable others must guide the students in their science lessons. | 3.50 | 0.61 | SA |
| 2. Classmates and friends must help the students understand the science lessons better given the current learning modality. | 3.64 | 0.53 | SA |
| 3. The teacher should encourage cooperation and collaboration among students in his/her Science class. | 3.70 | 0.51 | SA |
| 4. Parents and guardians must show financial, as well as moral and psychological support to the student's remote learning. | 3.54 | 0.61 | SA |
| 5. Local government units (LGUs) and barangay officials should support the educational needs | 3.52 | 0.68 | SA |

| | | | |
|---|---|---|---|
| of the students during this current learning modality. | | | |
| **Weighted Mean** | **3.58** | **0.59** | **SA** |

Legend: M-Mean; SD-Standard Deviation; VD-Verbal Description; Strongly Agree (SA

As exhibited in the table, the students also strongly agree on social support's role in successful science learning, garnering a weighted mean of 3.58 (M=0.59).

Furthermore, the students strongly agree with all the statements under the social support factor, with means varying from 3.50 to 3.70. Students strongly agree that collaboration among students must be encouraged (M=3.70), classmates and friends should provide help for better understanding and learning (M=3.64), and parents and guardians must provide help with student's financial needs and well-being (M=3.54). Results of the study show that the students need support from the external environment, specifically from surrounding individuals, on various aspects of their flexible learning in science. Students believe that aside from different academic support, holistic assistance of close individuals and higher institutions outside the academe also ensures successful science learning.

The results can be associated with the study of Elumalai et al. (2020), which reveals that social support impacts the quality of online and e-learning of students.

Table 7 shows the students' level of agreement in successful science learning in a flexible mode amid educational disruption in terms of technical support.

The table shows that the students strongly agree that technical support is a factor in successful science learning in a flexible mode, as shown by the weighted mean of 3.67 (SD=0.53).

The students show a strong agreement on all of the statements under technical support, showing a mean from 3.62 to 3.72. Statements on the said factor include the support provided to the student on the use of different devices (M=3.62), the help given to the students on different applications or software for activities and experiments (M=3.68), the user-friendliness of the technology provided for creativity, critical thinking, and technical skills. (M=3.68), discovery of new software and applications related to science with the instructor's assistance (M=3.64), and the compatibility of the instructor's application or software used by the instructors to the students' devices (M=3.72).

| | | | |
|---|---|---|---|
| **Weighted Mean** | **3.67** | **0.53** | **SA** |

Legend: M-Mean; SD-Standard Deviation; VD-Verbal Description; Strongly Agree (SA)

Table 7 Respondents' Level of Agreement on Technical Support in Successful Science Learning in a Flexible Mode

| Statements | M | SD | VD |
|---|---|---|---|
| 1. Instructors should support students in using different devices properly in learning science. | 3.62 | 0.57 | SA |
| 2. Instructors must help students determine what appropriate applications and software to use in doing activities and experiments in science. | 3.68 | 0.55 | SA |
| 3. The recommended technologies provided by the instructors must be user-friendly and must help improve the student's creativity, critical thinking, and technical skills. | 3.68 | 0.51 | SA |
| 4. The student should learn new software and applications related to science with the instructor's assistance. | 3.64 | 0.53 | SA |
| 5. The application or software used by the instructors should be compatible to the students' devices. | 3.72 | 0.50 | SA |

The result implies that the students recognize the need to have guidance on using technological resources and software for comfortable use and motivated, flexible learning. In addition, the students also recognize the need for coordination and communication between the instructors and students, specifically on the technical aspects of flexible learning. Moreover, the students also clearly determine the need for instructions on using learning platforms in science utilized in the current learning setup.

This supports the study of Shamsy (2014), which indicates that decreasing the technical difficulties and hindrances that cause frustration, isolation, and adverse effects on students' learning through support mechanisms helps in experiencing complete online education and directs students' focus on collaboration, engagement, and learning.

Table 8 shows the students' level of agreement in successful science learning in a flexible mode amid educational disruption in terms of internet accessibility.

Table 8 Respondents' Level of Agreement on Internet Accessibility in Successful Science Learning in a Flexible Mode

| Statements | M | SD | VD |
|---|---|---|---|
| 1. Teachers must consider internet accessibility in sending digital copies of the modules to the students. | 3.88 | 0.39 | SA |
| 2. Internet stability must be considered to ensure successful learning in science. | 3.86 | 0.40 | SA |
| 3. Access to websites and open educational resources in science subjects must be encouraged in learning during this time. | 3.78 | 0.46 | SA |
| 4. Good internet connection must be ensured when giving science assessment online. | 3.64 | 0.53 | SA |
| 5. Instructors must consider students' internet accessibility in designing student learning plans to ensure the effectiveness of instruction. | 3.76 | 0.48 | SA |
| **Weighted Mean** | **3.78** | **0.45** | **SA** |

Legend: M-Mean; SD-Standard Deviation; VD-Verbal Description; Strongly Agree (SA)

As displayed in the table, it is revealed that the students strongly agree on the role of internet accessibility on students' successful science learning in a flexible mode, as shown by the weighted mean of 3.78 (SD=0.45).

Statements under internet accessibility are strongly agreed upon by students, with a mean ranging from 3.64 to 3.88. Students strongly agree that students' internet accessibility (M=3.88) and internet stability (M=3.86) must be considered. The use of accessible scientific websites and open educational resources in science subjects must be encouraged (M=3.78). Further, a good internet connection must be ensured specifically on giving online assessment (M=3.64), and student's internet accessibility must be considered in designing learning plans (M=3.76). This suggests that the students need good internet connectivity to achieve quality education and successful science learning in a flexible mode. Furthermore, it shows that the students believe that instructors must consider and understand their internet concerns. It can be concluded that the students recognize the role of strong, stable, accessible internet connection during flexible learning mode. The findings can be related to the study of Yebowaah (2018), which states that students with access to internet sources show more academic

performance compared to students without access.

Table 9 summarizes the respondents' level of agreement on different factors for successful science learning in a flexible mode amid educational disruption.

Table 9 Summary of the Respondents' Level of Agreement on Different Factors for Successful Science Learning in a Flexible Mode

| Factors | M | SD | VD |
|---|---|---|---|
| Instructors Characteristics | 3.79 | 0.47 | SA |
| Internet Accessibility | 3.78 | 0.45 | SA |
| Administrative Support | 3.69 | 0.53 | SA |
| Course Content And Design | 3.69 | 0.54 | SA |
| Technical Support | 3.67 | 0.53 | SA |
| Learners Characteristics | 3.66 | 0.52 | SA |
| Social Support | 3.58 | 0.59 | SA |

*Legend:* M-Mean; SD-Standard Deviation; VD-Verbal Description; Strongly Agree (SA)

The students strongly agree on the different factors for successful science learning in a flexible mode. The students strongly agree on instructor characteristics (M=3.79) as a primary factor for successful science learning in a flexible mode, followed by internet accessibility (M=3.78), administrative support (M=3.69), course content and design (M=3.69), technical support (M=3.67), learner characteristics (M=3.66), and social support. (M=3.58). This suggests that among all the given factors, the students believe how their science instructors teach and approach during the flexible mode determines their success in learning during this current learning setup.

The results of the study are similar to those of Glazier (2016), which states that a high-rapport relationship between instructors and students is a crucial factor in the success of students' online classes, improving students' grades and online retention.

**Differences in Respondents' Level of Agreement on the Different Factors for Successful Science Learning**

There is no significant difference in the student's evaluation of the seven factors for successful science learning among the different sex. This implies that male and female respondents' assessment of the factors for successful science learning in a flexible mode was not significantly different. The results can be associated with the study of Cabual (2021), which indicates that there is no substantial difference between the learning styles of the students and preferred learning modalities when grouped in terms of sex.

The student's assessment of the seven factors for successful science learning was not significantly different among the different year levels. This determines that there is no significant difference between the assessment of factors for successful science learning in a flexible mode when grouped according to the student's year level. The results can

also be related to the study of Cabual (2021), which states that there is no substantial difference among the students' learning styles and preferred learning modalities when grouped according to area or major of specialization.

Also, the student's assessment of the seven factors for successful science learning was not significantly different among the university's two campuses. This suggests that the respondents' assessment from Campus A and Campus B on the factors for successful science learning in a flexible mode was not significantly different.

The assessment on factors of students aged 17-18 years old, 19-20 years old, and 21 years old above was not significantly different from one another. This implies no significant difference among the factors for successful science learning in a flexible mode when grouped according to students' age. The study of Staddon (2020) can be related to the results as the study suggests no difference in attitudes towards technology between the mature and younger groups.

An analysis of variance (ANOVA) was done to explore the differences in students' assessments of the factors for successful science learning in a flexible mode by flexible modality. As revealed, there is a statistically significant difference between the students' assessment of instructors characteristics ($p=0.002$; $f= 4.259$), learners characteristics ($p=0.035$; $f=2.427$), and technical support ($p=0.016$; $f=2.972$). This suggests a significant difference in the factors as mentioned above for successful science learning in a flexible mode when grouped according to the flexible modality used. Moreover, there was no significant difference in administrative support, course content and design, social support, and internet accessibility as factors for successful science learning in a flexible when grouped according to the flexible modality used.

This can be associated with the study of Malik et al. (2017), which states that there is a statistically significant difference in the effectiveness of activities under asynchronous and synchronous e-learning based on students' responses.

Further, students' assessment of the seven factors for successful science learning was not significantly different among the seven brackets of family monthly income. This implies that there is no significant difference in the factors for successful science learning in a flexible mode when grouped according to the student's family monthly income. This can be associated with the findings of the study by Lin and Han (2017), which indicates that family income level

shows no significant influence on children's academic achievement. However, the study shows that family income significantly influences children's education level.

Table 10 shows the correlation coefficient of different factors for successful science learning in a flexible mode.

Table 10 Correlation Coefficients among the Factors for Successful Science Learning

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Administrative Support | — | | | | | | |
| Course Content and Design | 0.644** | — | | | | | |
| Instructors Characteristics | 0.579** | 0.797** | — | | | | |
| Learners Characteristics | 0.556** | 0.601** | 0.638** | — | | | |
| Social Support | 0.676** | 0.706** | 0.632** | 0.683** | — | | |
| Technical Support | 0.839** | 0.718** | 0.688** | 0.764** | 0.801** | — | |
| Internet Accessibility | 0.697** | 0.603** | 0.748** | 0.665** | 0.771** | 0.744** | — |

***. Correlation is significant at the 0.01 level (2-tailed).*

As displayed in the table, statistically positive significant relationships, ranging from moderate to high correlations, are observed between the factors for successful science learning. Positive moderate correlations are noted between course content and design and administrative support (r=0.644; p<0.01), instructors characteristics and administrative support (r=0.579; p<0.01), learners characteristics and administrative support (r=0.556; p<0.01), social support and administrative support (r=0.676; p<0.01), and internet accessibility and administrative support (r=0.697; p<0.01). In addition, moderate and moderate positive correlations are noted between learners characteristics and course content and design (r=0.601; p<0.01), internet accessibility and course content and design (r=0.603; p<0.01), learners characteristics and instructors characteristics (r=0.638; p<0.01), social support and instructors characteristics (r=0.632; p<0.01), technical support and instructors characteristics (r=0.688; p<0.01), social support and learners characteristics (r=0.683; p<0.01), and internet accessibility and learners characteristics (r=0.665; p<0.01).

Furthermore, high positive correlations were observed between technical support and administrative support (r=0.839; p<0.01), instructors characteristics and course content and design (r=0.797; p<0.01), social support and course content and design (r=0.706; p<0.01), technical support and course content and design (r=0.718; p<0.01), internet accessibility and instructors characteristics (r=0.748; p<0.01), technical support and learners characteristics (r=0.764; p<0.01), technical support and social support (r=0.801; p<0.01), internet accessibility and social support (r=0.771; p<0.01), and

internet accessibility and technical support ($r=0.772$; $p<0.01$).

The result of the study implies that when the respondent's level of agreement on a specific factor in successful science learning in a flexible mode increases, other factors will also likely increase. The finding supports the study of Elumalai et al. (2020), which found a significant positive relationship between the factors of the quality of learning among higher educational institutions during the pandemic.

## CONCLUSION

The study assessed different factors for successful science learning in a flexible mode utilized in science education students' current learning setup. The study results addressed the need for more literature regarding students' assessment of factors for successful learning, specifically in science, in flexible mode during the educational disruption, as most of the studies focused on challenges and teachers' perception of online education and learning. Results of the study showed that most respondents use smartphones as a device for flexible learning and asynchronous class as a flexible learning modality. Furthermore, the respondents strongly agree with all the factors that ensure successful science learning in a flexible mode. The instructors' characteristics are the primary factor, followed by internet accessibility, administrative support, course content and design, technical support, learner characteristics, and social support. The study also revealed no significant difference among the factors for successful science learning in a flexible mode when grouped according to profile variables except between the flexible learning modality used and the instructor characteristics, learners' characteristics, and technical support.

Moreover, positive significant moderate to high correlations were noted among factors for successful science learning in a flexible mode. The respondents also stated that aside from the factors presented, other factors that can affect their learning in science include conducting laboratory work and experiments, learning/working environment, mental/emotional conditions, resources, and the time/deadline. Furthermore, when asked what support ensures their successful science learning during the COVID-19 pandemic, instructor support gathered the most responses while time management gathered the least.

The study recommends that training and seminars that focus on enhancing content knowledge and pedagogy in teaching science during this flexible mode should be given to instructors. This may include training

and seminars highlighting techniques and strategies for science teaching during the pandemic and creating and conducting laboratory works and experiments that are doable during the current learning setup.

Furthermore, the university may also create programs and policy instructions that cater to and address inquiries and concerns of students during this current learning setup. Creating these helps to avoid learning losses among students and make the current learning modality effective, efficient, responsive to the learning needs of the students, and conducive for both the faculty and students. Furthermore, the university may prioritize providing holistic support to the students' flexible learning, specifically strengthening and enforcing social support through tapping and collaborating with local government units (LGU) and other social institutions vital for learning.

Although the study results provide insightful students' assessment of factors for successful science learning in a flexible mode utilized during the current learning setup, there are limitations in this study. The study only involves science education students, limiting the results' generalizability to other education students of other majorships. Also, involving only science learning limits the generalizability of the results to learning other fields of study. The limitations of this study also include only the students' assessment without the teachers' assessment. Since the study was limited only to one university, further research can be conducted to include other universities and colleges in other regions across the Philippines to have better generalizability. Furthermore, future studies should also employ a qualitative approach and research tools to have a more profound and in-depth understanding of factors for successful science learning in a flexible mode utilized during the current learning setup brought about by the COVID-19 pandemic.

**ACKNOWLEDGEMENT**

The researchers would like to thank President Ramon Magsaysay State University for the approval of this research project. To the Office of the Dean of the College of Teacher Education for permission granted to conduct the study. Lastly, to the science teacher education students for the time afforded to respond to the survey. The editors and blind peer reviewers for the suggestions that enhanced this research article.

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