

# Impact Assessment on the Utilization of Portable Multi-Lens Off-Chip Cellphone Microscope: An Extension Activity to Munguia National High School, Dupax Del Norte, Nueva Vizcaya, Philippines

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**Abstract:** Within the last few years, cellphone subscriptions have widely spread and now cover even the remote part of the locality. Adequate access to a microscope, however, is not widely available, especially in secondary schools. Cellphone microscopes have the potential to revolutionize health-related screening and analysis for a variety of applications in biology and environmental science. The approach is unique in its optical design: the different lens set-up is placed, separated by its focal length on a microscopic sample and directly imaged from a detached camera phone, which allows different viewpoints of the sample to be recorded. Therefore, these demands support the research around microscopy. This study investigates the impact of the capability building conducted at Munguia National High School, Dupax del Norte, Nueva Vizcaya, on the utilization of a low-cost scientific device for microscopy through the portable multi-lens off-chip cellphone microscope. To implement the evaluation, researchers made use of a quantitative descriptive research design through a survey questionnaire with a 4-point Likert scale. With an overall weighted mean of 3.00, results showed that the said technology is a valuable and user-friendly tool for students of all abilities, enhances professional development, and promotes student collaboration. The findings of this study would be a motivation to enhance the extension service to the partner organization.

**Keywords:** capability building, extension program, impact assessment, multi-lens off-chip cellphone microscope.

## 1. Introduction

Microscopy has emerged as a key component of STEM (Science, Technology, Engineering, and Mathematics) education in the academic strands, offering students practical experiences that connect theory to real-world application [1]. They give students hands-on experience observing and analyzing microscopic structures, transforming passive textbook study into active involvement. Microscopes pique students' interest and improve their understanding of the natural world's complexity by allowing them to see cells, bacteria, and other small creatures [2].

By making microscopy more approachable and interesting,

the use of digital microscopes has further revolutionized teaching. Students can take and share pictures with digital microscopes, which promotes group learning and lets teachers use multimedia to create engaging courses. According to studies, using digital microscopes in biology lectures for example boosts student motivation, enhances the standard of instruction, and develops critical thinking and problem-solving abilities [3, 4].

Aside from biology, microscopy plays an important role in education, influencing disciplines like criminology, geology, and materials science. Through the ability to examine minute details, microscopes encourage curiosity and a more profound comprehension of scientific concepts. This practical method not only improves learning results but also gets students ready for jobs in a variety of scientific fields [5].

The conversion of conventional microscopes into multi-lens off-chip microscopes signifies a substantial improvement in affordability, portability, and accessibility, especially for educational and medical uses. Miniaturization and sophisticated optics are used in off-chip microscopes, such as to provide small, light devices that can be included in portable platforms like smartphones. This invention makes microscopy more accessible to a wider audience by allowing its application in remote or resource-constrained environments where conventional microscopes are impracticable because of their size, expense, or complexity. By eliminating the need for large external optics and streamlining sample preparation, off-chip microscopes can enable quicker, more effective diagnostics and instructional activities, enabling a wider audience to access high-quality microscopy.

To determine whether using off-chip microscopes as an extension activity at Munguia National High School improves science instruction, a comprehensive impact assessment is required. Students get firsthand exposure to cutting-edge scientific instruments by incorporating these gadgets into the

curriculum, which develops their practical and critical thinking abilities. To ascertain the program's instructional value, student engagement, and scalability potential, it is imperative to evaluate its impact. Metrics including enhanced academic achievement heightened interest in science subjects, and comments from teachers and students would help reveal the program's strengths and shortcomings.

## 2. Materials and Methodology

### A. Multi-Lens Off-Chip Microscope

The feature of a multi-lens off-chip cellphone microscope, as shown in Fig. 1, is based on the principle of cellphone microscopy and has been presented as a new approach for low-cost, cellphone-based microscopy that secondary schools can use. The multi-lens off-chip microscope is designed to have an overall dimension of 200 x 200 mm and can magnify specimens up to 375X resolution.

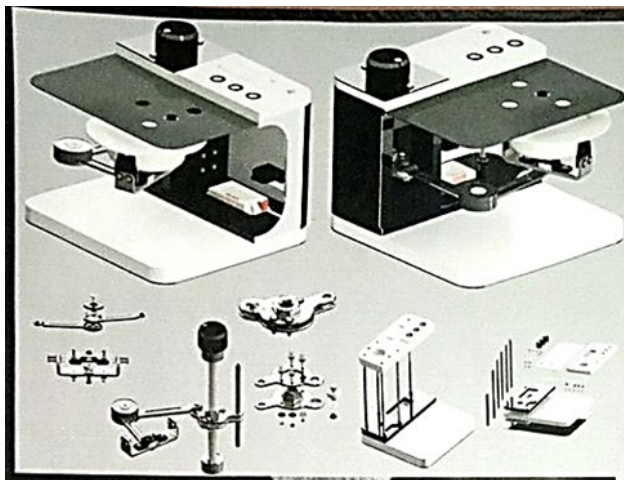


Fig. 1. Multi-lens off-chip cellphone microscope

### B. Locale of the Study

The said extension activity is conducted at Munguia National High School, Dupax del Norte, Nueva Vizcaya Philippines, which constitutes high school students from grades 7 to 12. This institution was considered as the adopted school of Nueva Vizcaya State University, Bambang Campus, spearheaded by the Department of Mechanical Engineering to serve as the social laboratory of its students to demonstrate the interface of instruction and extension mandate by the college.

### C. Research design and data gathering instrument

The study made use of a qualitative descriptive research design. It was used to describe the profile of the respondents, and the different projects/activities provided in its service community. It likewise accounts for the assessment of the respondents on the impact of the extension program concerning acquired knowledge, skills, values, and attitudes. Frequency and percentage were used to treat data along the profile of the respondents [6]. Here, the main instrument used in this study

was a survey questionnaire. The questionnaire had two parts. Part I pertains to the profile of the respondents. Part II elicited the impact of the capability building provided in the community in terms of technological learning on the extended multi-lens off-chip microscope.

A 4-point Likert scale is utilized in the questionnaire to determine the impact of the extension project and activities concerning acquired knowledge, skills, and values because of the capacity-building training initiated by the Department of Mechanical Engineering of the Nueva Vizcaya State University. The Likert-type scale assumes that the strength/intensity of experience is linear, for instance, on a continuum from strongly agree to strongly disagree, and that attitudes can be measured [7]. The main advantage of a 4-point Likert scale is that it eliminates neutrality, requiring responders to choose a position. This is especially effective when researchers wish to avoid neutral or noncommittal responses and encourage participants to express a strong view or preference.

## 3. Results and Discussion

This section discusses significant results about the impact of capability building on the said extension program at Munguia National High School, Dupax del Norte, Nueva Vizcaya, which are summarized through tables. This would bring insights to the program based on the responses of the said partner organization.

Table 1  
Profile of respondents

Age range	Frequency	Percent (%)
15 - 18	16	53.33
19 - 20	8	26.66
20 - 24	0	0
35 - 39	2	6.67
40 - 45	2	6.67
45 - 50	2	6.67
Total	30	100%
<b>Gender</b>		
Male	16	53.33
Female	14	46.67
Total	30	100%

The respondents' profile is presented in Table 1. It shows that most of the respondents (80%) belong to the age bracket 15 - 20 years with a mean age of 18 years old, which means the respondents are middle-aged senior high school students, while the rest are faculty members or teachers. It also reveals that there are more male respondents (53.33 %) than female respondents (46.67%) for both high school students and teachers.

In the context of the technological usage of the multi-lens off-chip cellphone microscopes from Table 2, an overall weighted mean of 3.00 on a four-point Likert scale with a descriptive value of "strongly agree" means that most respondents agree with the advantages of using microscopes for study or work. Moreover, the participants find the technological

Table 2

Technological learning on the utilization of portable multi – lens off – chip cellphone microscope		
Descriptions	Mean	Descriptive Value
Increased academic achievement to students	3.2	Strongly Agree
Does not make classroom management more difficult	3.0	Strongly Agree
It is a valuable and user–friendly instructional tool	3.3	Strongly Agree
Makes teachers more competent as educators	3.2	Strongly Agree
Allows teachers to be facilitators	3.2	Strongly Agree
Does not demand too much time to be spent on technical problems	3.0	Strongly Agree
It is an effective tool for students of all abilities	3.3	Strongly Agree
Enhances my professional development	3.3	Strongly Agree
Promotes student collaboration	3.3	Strongly Agree
It is not too costly in terms of resources, time, and effort	3.3	Strongly Agree
Able to operate the said technology confidently	3.2	Strongly Agree
Able to appreciate the minute specimen to a clearer magnification	3.3	Strongly Agree
Enhances teacher–student mentorship and learning experience	3.2	Strongly Agree
Strengthens visualization skills	3.3	Strongly Agree
Easy and faster access to data needed	3.3	Strongly Agree
Overall weighted mean	3.00	Strongly Agree

\*Rating qualitative descriptions:

4.00 – 3.00 Strongly agree

2.99 – 2.00 Agree

1.99 – 1.00 Disagree

1.00 – 0.99 Strongly disagree

elements of the microscope useful and effective, even though they might not be overly excited about them. The clientele have emphasized that the extended instrument is a valuable and user – friendly instructional tool; an effective tool for students of all abilities; enhanced professional development; promotes student collaboration; not too costly in terms of resources, time and effort; appreciate the minute specimen to a clearer magnification; strengthens visualization skills and easy and faster access on data needed giving a mean value of 3.3.

#### 4. Conclusion

In conclusion, the said extension activity at Munguia National High School was beneficial to the clientele especially on the utilization of portable multi – lens off – chip cellphone microscope, which is acknowledged to be a valuable and user – friendly instructional tool; an effective tool for students of all abilities; enhanced professional development; promotes student collaboration; not too costly in terms of resources, time and effort; appreciate the minute specimen to a clearer magnification; strengthens visualization skills and easy and faster access on data needed. The said technology excites the end users, and it is utilized in their science classes.

Future works of this study as per the suggestion of the clientele, include increasing the magnification capability of the portable multi–lens off–chip phone microscope and additional units for fabrication.

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