# Application of Learning Brochure in Mitosis: Effects on Mainstream Learners' Test Performance in Biology 8

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**DOI: https://doi.org/10.47772/IJRISS.2026.10100240**

**Received: 13 January 2026; Accepted: 18 January 2026; Published: 02 February 2026**

## ABSTRACT

Mainstream learners are often marginalized in the classroom when instructional practices fail to address their specific educational needs. These are difficulties or disabilities that make it harder for a child to learn than most peers of the same age. This preliminary study examined the effectiveness of a learning brochure as an instructional intervention in Biology 8 in the topic Stages of Mitosis among mainstream learners. A one-group pretest–posttest design was employed to assess changes in academic performance and to examine the relationship between learner profiles and test outcomes. It showed that the majority of the respondents were female and aged 13-15 years, they completed a pretest, then independently studied a take-home learning brochure for 24 hours, and completed a posttest. Due to the small sample size, non-parametric statistical analysis was used. Results revealed a strong, statistically significant negative correlation between age and posttest scores ($\rho = -0.708$, $p = 0.049$), indicating lower posttest performance among older mainstream learners. A moderate positive correlation was observed between pretest and posttest scores ($\rho = 0.490$), though this relationship was not statistically significant ($p = 0.218$). These suggested a general trend that better initial performance leads to better final performance, thus, the learning material in Biology 8 showed initial effectiveness in the positive performance of the mainstream learners. Subsequently, gain scores implied that the learning brochure may support improved academic performance. Future researches should involve larger samples, longer study periods, and additional Biology topics to promote its relevance.

**Keywords:** Biology 8, Learning Brochure, Mainstream Learners, pretest-posttest, Stages of Mitosis

## INTRODUCTION

Assessing the test performance has been and will be a necessity not only in biology education but in all academies. It is not just a mere check-up in the school curriculum but a springboard of scientific and educational evaluation. In spite of its significance and vital role in the development of every institution, assessment is a task that often disliked and hated by most leaners. They consider it as an agony to their lives and escape it, if possible. Assessment like multiple-choice required both mental representation skills and reading comprehension skills. Thru this process, aside from guiding students in understanding their progress, educators can refine teaching environment, learning materials and pedagogy.

Printed learning materials can be defined as any type of concrete material used to help teachers carry out teaching and learning activities in the classroom. Print teaching materials come with books, handouts, maps, magazines and brochure [1]. Thus, an authenticated brochure in stages of mitosis consisted of exciting shapes and colors of the actual cell hypothetically is an effective tool for teaching Mitosis in Biology 8. On the other hand, as mentioned by [2], mainstreaming is the practice of educating learners with special needs in regular classes during specific time periods, based on their individual skills. The mainstreaming method was used to place these type learners in a more competitive environment with lesser restrictions. Due to their inherent disability, these learners can be prone to discriminations from their classmates and often be marginalized in the regular classroom setting. It directly contradicts the aim of the Department of Education-Philippines that "no learners should be left behind", hence, one of the solutions in this problem is differentiated instruction. In the study of [3], they

explored what contributes to the development of differentiated instructions through the use of curriculum modifications for the inclusion of students with special educational needs in three primary Singaporean schools. Findings indicated that contextual constraints, such as class size, learning material and national exams constitute critical impediments that affect the types of curriculum modifications used. This implies a need to consider the contextual features that impact upon the quality of learner-centered instruction internationally for mainstream learners.

Institutions in the Philippines that openly accommodate learners with special needs thru mainstreaming can be challenging to find and often uncooperative to researches due to ethical and religious reasons. However, the institutions' continuing endeavor toward a more inclusive education have challenged and inspired the researchers to conduct this baseline study, with eight (8) respondents, to determine the effectiveness of an authenticated brochure in mitosis for teaching mainstream learners. In the systematic review of [4] in the last 20 years of literature that characterized the use of printed learning material one of those is 3D in biological education, only finding a total of 13 articles that attempted to investigate the benefits for student learning. So, it is challenging to make broad claims about student learning in relation to using or creating printed models in the context of biology education. Accordingly, this study determined the effects in the application of a learning brochure in mitosis on the test performance of the mainstream learners in grade 8.

Specifically, the study solved to the following objectives:

1. Identify the profile of the learner-respondent in terms of their age and sex.

2. Determine the relationship between the respondents' pretest and posttest gain scores after the intervention

3. Assess the relationship between the Mainstream learners' age with their test performance in the topic Stages of Mitosis.

**Hypothesis**

**Ho.** There is no relationship between the respondents' pretest and posttest scores in the topic Stages of Mitosis.

**$H_1$.** There is a relationship between the respondents' pretest and posttest scores in the topic Stages of Mitosis.

## LITERATURE REVIEW

This aspect were the academic writings that served as a comprehensive survey of scholarly sources relevant to this topic and research goals.

### Learning Materials in Education

[5] stated that effective teaching of any subject would stimulate students' interest in the subject and enhance the applicability of the concept in real-life situations. To achieve effective teaching and learning processes, there is a need for the use of materials, it could be printed or non-printed. Printed materials are teaching aids that teachers employ to facilitate his or her teaching for the achievement of the stated objective. It was discovered that the improvised learning materials like developing a brochure, produced the same performance as standard instructional materials. From the results of the study, it can be deduced that improvised instructional materials were very useful in teaching concepts. Improvised instructional materials can be those teaching and learning materials produced using locally available resources with the help of experts. Improvisation tends to remove abstractions in learning theories because the products of improvisation are tangible, handy, and concrete.

Science should start with hands-on experiences that the child is familiar with, not with abstract definitions of science. Learning apparatus from locally available materials is believed to enrich the capacity to observe, explain and do real science in primary schools and increase the quality of learning. Comparatively, the low-cost materials offered an alternative solution to doing science in classrooms under difficult financial constraints [6].

Furthermore, according to the study of [7], it was indeed observed that students are motivated and excited by the creativity and the use of improvised materials. Hence, given the shortage of science labs in schools and the imperatives related to implementing the Competence Based Curriculum, was highly recommended that Physics teachers use improvised experiment materials in their daily teaching activities to improve the student's learning and achievements. It is better that Biology teachers should constantly use improvised learning materials in teaching the subject to facilitate students' understanding of instructions and improve their academic performance. It was concluded that the availability and utilization of these materials positively affect the teaching and learning of Biology.

**Visual Scaffolds in Science**

According to [8], visual scaffolding, is a type of scaffolding provided in a visual format, it is considered to have potential in web and none web-based learning environments as it naturally includes tacit information, highlights the critical features of tasks and promotes learning through the spatial organization of tasks. So does learning brochures, it is crucial for simplifying complex topics, boosting engagement, and improving retention by presenting information visually, acting as a convenient study guide, and increasing comprehension for both students and educators. The development of scientific visual literacy has been identified as critical to the training of tomorrow's scientists and citizens alike. Visual representations frequently incorporate various components, such as discipline-specific graphical and diagrammatic features, varied levels of abstraction, and spatial arrangements of visual elements to convey information. Visual literacy is achieved when an individual understands the various ways in which a discipline uses these components to represent a particular way of knowledge acquisition [9].

**Teaching Strategies and Training for Mainstreaming**

Education specialists are strongly advocating the use of collaborative teaching (co-teaching) approaches to facilitate the inclusion of pupils with Special Educational Needs (SEN) in mainstream settings. After participating in co-taught numeracy classes for seven months, a standardized Mathematics test was administered. These scores were compared to the pupils' scores from the previous year when co-teaching was not the primary mode of instruction. A significant increase in pupils' overall standardized test scores was noted ($p$ = .002) [10]. The results of this study showed that co-teaching have a positive implication on the mental capability of the all the learners in a mainstream set-up.

According to [11], classroom teachers carry out in-class practices for teaching methods and activities of their mainstreaming students, and benefit from visual materials that they prepared with an assistant teacher. However, the classroom teachers also stated that they are unable to allocate time for their mainstreaming students because of the large numbers of students in the class and therefore they send their mainstreaming students to the special education teachers in their schools. It was determined that classroom teachers make their evaluations based on the level, interest and ability of students when evaluating the effectiveness of teaching. On the other hand, due to the shortage of autism-specific professional development, the implementation of the international Autism Spectrum Disorder-Empowering and Supporting Teachers (ASDEAST) project was realized. [12] aimed to identify the post-autism-specific professional development increase of teachers' knowledge concerning the characteristics of students with ASD and teachers' subjective confidence regarding their professional competencies. Their results showed that the training opportunity was considered by teachers to be important and effective. The results provide grounds for concluding that the program may be recommended for practical use in order to train teachers who will work with students with ASD.

Moreover, itinerant early childhood special education teachers (ECSETs) are important resources in providing support to children with special educational needs (SEN). The results show that ECSETs own professional ambition and children's support needs affect the work the most. Furthermore, inequality in ECSETs working conditions have direct consequences for practice. It concludes with a discussion of how ECSETs' working conditions influence the support that children receive and areas that should be addressed to ensure equal and efficient learning for all children [13].

**Trends in Mainstream Education**

In the U.S., K–12 students with special needs are increasingly enrolling in online schools in hopes of improved opportunities and outcomes. Researchers interviewed five special education students enrolled in a targeted

online school, along with their parents (n = 9), to better understand their motivations for enrolling and their experiences of what worked for them in the unique setting. Students and parents explained how their prior schools had not worked for them, and how the online school better met their needs for self-determination, mattering, differentiation, and positive socialization [14]. These findings gave a hint to the stakeholders and government leaders that online schools provide the best learning opportunities for special education learners.

In relation, policies aiming to promote the mainstreaming of students with special educational needs in regular classrooms have become a focal point of political discussions in many countries. Findings revealed that the likelihood of attaining an upper secondary certificate is significantly higher (by 18 percentage points) among students in regular classrooms. Furthermore, tentative results indicate that higher passing rates at the lower secondary school leaving exam may play a mediating role [15]. Specifically, the move to included students with special educational needs (SEN) in mainstream education is one of the priorities of educational reform agendas in many countries. In Flanders (Belgium) the aim is to implement a more inclusive school system, but it faces resistance from practitioners. The results showed that Teachers' Self Efficacy is lower regarding students with multiple diagnoses compared to students with one diagnosis, and lower regarding students with socio-emotional and behavioral disorders compared to students with learning disabilities. In addition, teachers' use of cooperative sources of support, such as team teaching, observation and feedback, supervision, and student support within and outside the classroom for students with SEN, predicted higher levels of TSE. These findings suggest that investing in these forms of support can improve teachers' competency in dealing with students with SEN and reduce their resistance to inclusive education [16].

**Science and Math Education in the classroom**

Science Education has an important role in raising individuals who can adapt to developing world with the 21st century skills. Within the scope of science education, biology covers information that individuals can make use of in their daily lives. This makes Biology teaching even more important. Teachers assume great responsibilities in the realization of an effective biology teaching. One of these responsibilities is the use of equipment and materials in teaching because the use of equipment in teaching helps with learning the information in an effective, permanent and meaningful way. It is also creating an active and fun classroom environment. Biology teachers should choose suitable material for the course, subject, students' level, setting and objectives [17]. They should also be able to develop learning materials in line with learning outcomes and provide the students with the necessary information about the teaching materials. It is noted that teachers must show the importance in using this equipment for teaching and demonstrate that equipment and materials are indispensable facilitators for an efficient and effective teaching not only in Biology but also in other fields like Mathematics.

Learners in math usually get used to doing a slight review of a problem and then try to solve it immediately, the problem statement did not explicitly exhibit a quick way of solution, so it was necessary to spend time understanding the problem, making some plan for the solution and analyzing that plan before carrying it out (similar process in developing a learning brochure). In mathematics, Polya's method is one of the techniques that utilized this process. Results in the study of [18] implies that respondents agreed that Polya's method effectively improves problem-solving skills in terms of understanding, planning, implementation, and look back analysis, the intervention plan is designed to improve delivery systems and improve students' problem-solving skills. In addition, the study of [19] indicated that the learning management developed using applied collaborative learning and problem-solving process was effective in developing students' mathematical problem-solving skills. The students' learning achievement of surface area and volume in the posttest was higher, and the students were satisfied with learning with the lesson plans using the applied cooperative learning and Polya's problem-solving process. Therefore, based on these studies the learners have the ability to perform mathematical problem but in order to increase the performance level, applying Polya's method is one of the solutions.

# METHODS

The present study used a quantitative method in collecting data. Questionnaires were directly administered by the researchers to the respondents. Then, the gathering of data was conducted during the 4$^{th}$ week of November 2025. It was deployed at Junior High School Department, Mercy Junior College Inc. (MJCI), in Tubod Lanao del Norte, Philippines, 3$^{rd}$ quarter of the school year 2025-2026. This institution is a Catholic private school in distinction and aims to help the students prepare in serving humanity in the future. Furthermore, the study was

the application of the expert-validated learning brochure in stages of mitosis, these panel of experts were composed of doctors in biology education and also biology teachers instructing for more than ten (10) years. The respondents of this study consisted of eight (8) Mainstream Learners, specifically, learners identified to have special needs and currently attending regular classes in grade 8. The researchers relied on their own judgment to meet the specific characteristics needed for the study. Thus, it used purposive sampling, a non-probability sampling method wherein the researchers intentionally select participants based on specific characteristics which are relevant to the study's objectives and were verified by the school administration.

The instrument used was the Department of Education- Philippines validated multiple choice type test. It was made in pretest and posttest set-up to determine the gain scores of the respondents bordered by the intervention of the learning brochure in stages of mitosis. The test items were checked by the experts for validation and responses of the respondents was tested for reliability. After the pretest and posttest questionnaires were formulated, the researchers had set a date to conduct the tests. After the pretest, a 24-hour take home intervention of the learning brochure was made, eventually, researchers conducted a post-test to the same set of learners. Thru analyzing the data gathered, the results were calculated to attain the objectives of the study. After the test of normality, this research used a Wilcoxon Signed-Ranked Test, due to the number of respondents (N=8), a non-parametric test and, a tool to determine the difference between the pretest and posttest scores. Then, Pearson Correlation was utilized to assess the relationship between the respondents' age with their test performance. On the other hand, to comply with the ethical protocols, a research manuscript and a letter was forwarded to the MJCI directress to request authorization to conduct this study. After the approval was acquired, parents' consent from the respondents were secured.

## RESULTS AND DISCUSSION

This portion are the direct, factual outcomes or discoveries generated by analyzing the data collected during the study. Their primary purpose is to accomplish the research objectives and test the hypothesis that was posed in the introduction part of this paper.

**Table 1**

Table 1 showed the age of the respondents. Majority of them are 14 and 15 years old with one respondent being a 16-year-old. Thus, age 12% (16 years), 50% (13 and 15) and 38% (14). Hence, it somewhat reflected the ideal age for Grade 8 learner in the Philippines. *Age profile of the respondents*

| **Age (years)** | **Frequency** | **Percentage** |
|---|---|---|
| 13 | 2 | 25 |
| 14 | 3 | 38 |
| 15 | 3 | 25 |
| 16 | 1 | 12 |
| **Total** | **8** | **100** |

**Table 2**

The table below presented the sex of the respondents wherein 6 are Female and only 2 are Males. Therefore, 75% and 25% respectively, among the total of 8 respondents.

**Sex Profile of the Respondents**

| **Sex** | **Frequency** | **Percentage** |
|---|---|---|
| M | 2 | 25 |

| | | |
|---|---|---|
| F | 6 | 75 |
| **Total** | **8** | **100** |

**Table 3**

The p-values were 0.613 and 0.09 > 0.05 alpha level, not significant. Thus, the data-set was normally distributed at 0.05 significance level. In relation, due to the number of respondents in this study (only 8 mainstream learners) and the method of sampling (purposive sampling), the researcher selected the nonparametric test equivalent for T-test which is the Wilcoxon Signed-Ranked Test to determine if the average change in scores is statistically significant, comparing one respondent's gain to zero.

**Test of Normality using Spiro-Wilk Test**

| | **Statistics** | **Df** | **P-value** |
|---|---|---|---|
| Pre-test | 0.848 | 8 | 0.09 |
| Post-test | 9.40 | 8 | 0.613 |

In the normal distribution case, the averaged rejection rate is 5.07%, which aligns well with the statistical expectation. However, in the non-normal distribution case, we see a slight inflation in the alpha level, with the averaged rejection rate reaching 5.75% [20]. On the other aspect, [21] presented that the main advantages of pretest and posttest change is to determine which individual cases changed reliably, then it facilitate the interpretation and communication of results and provide a straightforward evaluation of the magnitude of empirical effects.

**Table 4**

The individual improvements ranged from zero, Respondent 4, who scored 7 on both tests to a maximum gain of eight points, Respondent 5, who improved from 5 to 13. Respondents 2 and 7 also showed substantial gains of 6 and 4 points, respectively. This collective positive gain suggested that the intervention or instruction delivered between the pre-test and post-test may have been effective in increasing the respondents' knowledge, as measured by the test scores.

**Gain Score Results**

| **Respondent** | **Pre-test Score/15** | **Posttest Score/15** | **Gain Score** |
|---|---|---|---|
| 1 | 8 | 10 | 2 |
| 2 | 6 | 12 | 6 |
| 3 | 12 | 14 | 2 |
| 4 | 7 | 7 | 0 |
| 5 | 5 | 13 | 8 |
| 6 | 6 | 9 | 3 |
| 7 | 8 | 12 | 4 |
| 8 | 5 | 6 | 1 |

**Table 4**

The difference between the Pretest and Posttest scores was statistically significant because the p-value (0.018) < 0.05. This suggested that the learning brochure was effective and caused a statistically significant change in the scores of the respondents from pretest to posttest.

**Median difference of effects between pretest and posttest**

| Test | P-value | Decision |
|---|---|---|
| Wilcoxon Signed Rank Test | 0.018 | Statistically Significant |

**Table 5**

The variable sex could not be analyzed because it lacked any variation in the data set (2M,4F), rendering its correlation with other variables incomputable. Then, the relationship between the Pretest and Posttest scores (p-value = .490) was a moderate positive correlation, suggesting a general trend that better initial performance leads to better final performance, but this finding was not statistically significant (p-value = .218), meaning the observed pattern could reasonably be due to chance. The key finding from this correlation matrix is the strong, statistically significant negative relationship between Age and Posttest scores (p-value= -0.708, p-value = 0.049). This means that for this preliminary sample of participants (N=8), older individuals tended to score significantly lower on the posttest than younger individuals.

**Relationship between the respondents' age with their test performance**

| | | Age | Pretest | Posttest |
|---|---|---|---|---|
| **Sex** | Pear. Corr | .00 | .00 | .00 |
| | p-value | .00 | .00 | .00 |
| **Age** | Pear. Corr | 1.0 | -0.491 | -0.708 |
| | p-value | .00 | 0.216 | 0.049 |
| **Pretest** | Pear. Corr | -0.491 | 1 | 0.49 |
| | p-value | 0.216 | | 0.218 |
| **Post Test** | Pear. Corr | -0.708 | 0.490 | 1 |
| | p-value | 0.049 | 0.218 | |

There were multitude of reasons for measuring gain, for one, to evaluate the effects of instruction or other treatments over time and to compare individual differences in gain scores for the purpose of allocating service resources and selecting individuals for further study [22]. In this case, assessing the effectiveness of the applied learning material to mainstream learners. Furthermore, [23] recommended to utilize different growth models in schools like in this study used a learning material thru a brochure to increase posttest scores after the pretest. In addition, it enabled to determine student and school characteristics that have an impact on the students' gain scores.

## CONCLUSION

Several issues were magnified in conducting the pretest, implementing the learning material and posttest. These were mostly procedural aspects anchored on the researcher's monitoring of the 2-session implementation. Problems like unavailability of the mainstream learners, uncooperative schools, holidays and school activities hinders the deployment of the study. Hence, comprehensive adjustments and improvements should be made to address these issues. On the other aspects, the data collected was statistically non-normal due to the low number of mainstream learners who participated in the study. Consequently, it made the researcher proceed to a non-parametric test. In the assessment of test performance, the brochure for Biology 8 preliminarily showed a promising functionality since all the test scores of the mainstream learners increased. It opened the effectiveness of the learning material applied to these type of learners. The researchers recommended the use of this brochure in teaching Biology, specifically in the topic Stages of Mitosis in a mainstream classroom. For future studies, it

would be better if larger sample of mainstream learners will participate in the study because it opens a window to a stronger parametric statistical tools. Longer exposure to the learning material would also mean for a deeper learning and reduced rushing. Ideally, a comparison group to better support claims of effectiveness and exploring other topics in Biology will substantially add to the relevance of the study.

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## Ethical Considerations

Ethical approval was obtained for research involving human subjects and there is no conflict of interest in this study.

## Data Availability

All data will be available upon publication.