

# Development and Usability of Divigen Kit For Cell Division Topic In Biology Subject

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## ABSTRACT

This study aims to develop DivigenGen Kit, an innovative teaching aid that consists of interactive and systematic elements for Cell division topic in Biology subject. The innovation which employed developmental research design, has satisfied validity and excellent usability. DivigenGen Kit consists of three key components: a Pop-Out Book, DiviGen Replica, and Quick Test Series to support both visual and hands-on learning. A total of 22 Biology students from SMK Bukit Garam II, Kinabatangan, Sabah was chosen as the samples by using simple random sampling technique. The instruments used are usability questionnaire and validation form for DivigenGen Kit. Content Validity Index and Means was used to analyse validity and usability, respectively. The results demonstrated high usability, with a reliability score exceeding  $\alpha > 0.86$ . The kit also achieved outstanding validity, with a Content Validity Index (CVI) of 0.93 for content validity and 1.00 for face validity,

confirming its alignment with learning needs and curriculum objectives. In conclusion, the DiviGen Kit enhances teaching effectiveness by simplifying complex concepts like genetics, fostering deeper understanding among students. It offers an engaging and interactive learning experience, helping to shift the perception of Biology as a difficult subject and encouraging more students to pursue science streams. The kit's innovative design holds significant potential for transforming the teaching and learning of Biology.

**Keywords:** DiviGen Kit, Cell Division, Teaching Aid, Usability, STEM Education

## INTRODUCTION

The Ministry of Education Malaysia has introduced various initiatives to strengthen science teaching and learning, including Biology. One of the main challenges in teaching Biology is the topic of genetics, particularly cell division, which is often considered complex by students. The DiviGen Kit was developed as an interactive teaching aid to help students better understand this concept and enhance their learning experience. According to Wan Siti Hajar (2024), students' understanding in the field of biology is very low, especially for the topic of genetics. By utilizing the DiviGen Kit, students can observe the process of cell division from various angles, conduct observations, and test their level of comprehension. This approach provides a more interactive, visual, and practical learning experience, which has the potential to strengthen students' understanding of difficult genetic concepts. This study was conducted to identify the product's validity value from experts and the product's usability level.

## METHODOLOGY

### Study Design

According to Sabitha (2006), as referenced in the study by Alif Nawati and Gamal Abdul et al. (2015), research design is a systematic and detailed plan intended to ensure the validity and reliability of the obtained data. This study employed a quantitative approach using the ADDIE Model, a five-phase framework comprising Analysis, Design, Development, Implementation, and Evaluation. Data was collected via questionnaires to gather

participants' perspectives and feedback. The collected data underwent descriptive analysis to evaluate its usability, using the calculated mean and standard deviation.

## Population and Study Sample

The population for this study comprises students enrolled in biology subjects within the Kinabatangan district, Sabah. This research involved 22 Form Four students from a school located in the Kinabatangan district, Sabah. It is consistent with the findings of Budiu and Moran (2021), who indicated that usability studies with 5 to 15 participants are adequate for identifying over 90% of critical issues. Furthermore, the pilot study for this research utilized a sample size of 15 students (Chua, 2009). The respondents for this study were chosen through a purposive random sampling technique to ensure greater objectivity in the research outcomes.

## Instruments

The research instrument comprises product validity and instrument validity assessed by 3 qualified experts to evaluate face validity, content validity, and the kit's usability. Following this, a usability questionnaire instrument is employed to gauge the product's usability level among study respondents. The questionnaire research instrument undergoes a pilot study beforehand to confirm its validity and reliability.

## Validity

The validity of this kit is assessed from two different aspects, namely face validity for measuring the physical external characteristics of the kit and content validity to determine if the kit meets the learning objectives for the chosen topic, which is Cell Division. The selected experts are 2 lecturers from the Faculty of Science and Mathematics UPSI and 1 Biology teacher with over 5 years of experience as a biology teacher. The development of the DiviGen Kit and the usability questionnaire form need to obtain validity from these three experts to ensure the product and research instrument are appropriate. The Questionnaire Instrument contains three sections of questions divided into the elements present in the DiviGen Kit, namely i) Pop-out book, ii) DiviGen Replica, and Quick Test Series. After obtaining expert validity for this questionnaire instrument, the researcher calculates the cronbach alpha value for this instrument to determine the reliability level of each item in the instrument before distributing it to the pilot study and actual study samples. The questionnaire instrument in this study is adapted from Abdullah and Tze (2017). The validity form for product validity used in this study is divided into two (2) parts, namely part a) Face validity and b) Content validity. Questions for the face validity and content validity forms are determined using a Likert scale (Anjaria, 2022). After obtaining validity for face and content validity from the expert panel, the validity value is measured using the quantitative measurement procedure introduced by Lawshe (1975), namely the Content Validity Index (CVI). CVI functions to assess the extent to which the items in the instrument accurately represent the intended content within the research construct. This process involves an expert panel providing an assessment of each item based on its suitability and relevance to the research topic. This assessment is then quantitatively measured to obtain an index that can reflect the content validity level of the instrument. If the CVI shows a high value, it indicates that the instrument has good content validity, where each item is suitable and relevant for measuring the intended construct in the study. The questions for expert validity are adapted and modified from previous research by Abdullah and Tze (2017).

## Pilot study

A pilot study was conducted with the aim of obtaining the Cronbach Alpha index value or reliability for the research instrument and the developed product. The sample for this study consisted of 15 students who had similar backgrounds to the actual study respondents. Chua (2011) stated that the minimum sufficient sample size for a group is 15 people. The sampling technique used was random sampling, as this technique is believed to be more suitable for evaluating the usability of the developed product on a predetermined sample. The pilot study conducted on 15 Form 4 Biology students showed a Cronbach Alpha coefficient value of 0.86. A Cronbach Alpha value of 0.86 indicates an excellent level of reliability as it falls within the range of 0.80 to 1.0 (Lim, 2007). This data was obtained through a usability questionnaire distributed to the pilot study sample. This Cronbach Alpha value proves that each item in the instrument has high reliability and is suitable for use in field studies or actual research.

## Data Analysis

Data obtained through the product validation form and questionnaire validation form were analyzed using the Content Validity Index (CVI). Furthermore, to assess the usability and reliability of the DiviGen Kit, data from the pilot study were analyzed using the SPSS package to obtain the Cronbach Alpha value. Meanwhile, data obtained from the actual study through the usability questionnaire were analyzed using SPSS to obtain the mean score and standard deviation values.

## RESULTS AND DISCUSSION

### Face Validity and Content Validity

In this study, product validity and instrument validity forms were distributed to three experts, and the values provided by the experts were calculated and analyzed using the Content Validity Index (CVI). Based on Table 1, the CVI value for face validity was 1.00, while the content validity was 0.93. This indicates that all items in this study's instrument are relevant and accurate in describing the concepts being measured. With these high values, it provides confidence that the instrument used is effective and suitable for accurately achieving the research objectives, thereby strengthening the content validity of this study.

**Table 1. Mean value and Content Validity Index (CVI) for product validity**

Item	Mean	Content Validity Index (CVI)
Face Validity	3.38	1.0
Content Validity	3.42	0.93
	<b>Total</b>	0.96

### Reliability

A pilot study was conducted to assess the reliability level of the DiviGen Kit usability questionnaire instrument. To determine the reliability value of each item in this study's instrument, the Cronbach alpha value was measured as shown in table 2, for all 19 items.

**Table 2.0 Cronbach Alpha grade.**

Cronbach Alpha Value	Total Item
0.86	19

Based on table 2, the results of the pilot study indicate that the Cronbach's alpha value is at an excellent level, falling within the range of 0.80 to 1.0 (Lim, 2007). This data was collected via a usability questionnaire administered to the pilot study sample. The Cronbach's Alpha value demonstrates that each item within the instrument possesses high reliability and is appropriate for use in field or actual studies.

### Usability of the DiviGen Kit

**Table 3.0 Mean values and standard deviations for the Usability Questionnaire**

Construct	Mean	Standard deviations
Usability	4.78	±0.28
Satisfaction	4.74	±0.29
Learnability	4.68	±0.35
Usability	4.77	±0.32

Based on Table 3.0, the mean value for usability (4.78) indicates that respondents consider the product or system to be very useful, with a standard deviation of ±0.28 indicating consistency in the assessment. Satisfaction

recorded a mean of 4.74 and a standard deviation  $\pm 0.29$ , which indicates respondents are satisfied with this product, although there is a slight variation in their ratings. Learnability, with a mean of 4.68 and a standard deviation of  $\pm 0.35$ , indicates that there is a slight challenge for some users in learning this product, but it is still in a positive range. Usability, with a mean of 4.77 and a standard deviation of  $\pm 0.32$ , reflects the product's ease of use by most respondents. Overall, a high mean value for all constructs indicates good acceptance of this product or system. Low to moderate standard deviations showed that most respondents gave similar assessments, although slight variation existed, particularly in learning facilities. This shows that this product is useful, satisfying, easy to use, and easy to learn by the vast majority of user

## CONCLUSION

In conclusion, the DiviGen Kit for the topic of Cell Divisions has been successfully developed by obtaining an excellent level of validity, with an overall CVI value of 0.96 after being evaluated by three appointed experts. In addition, the kit also shows high reliability with a Cronbach's Alpha value of 0.86. Students' perceptions of the usability of the DiviGen Kit were very positive, with each construct obtaining a mean value above 4, close to reaching a maximum mean of 5, based on the Likert scale of 5 in the Usability Questionnaire instrument. Therefore, this Kit was developed to support teachers in the process of teaching the topic of Cell Division, as well as to help students learn this topic more effectively and interestingly through the approaches provided in the DiviGen Kit.

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