JURNAL PENDIDIKAN TEKNIK SIPIL

Comparison of Using Android-based Lux Meter and Split Flux Method in Natural Lighting Material in Building Physics Course

Nuzulul Alifin Nur

Research paper

Comparison of Using Android-based Lux Meter and Split Flux Method in Natural Lighting Material in Building Physics Course

Nuzulul Alifin Nur[*]

Universitas Negeri Yogyakarta, Department of Civil Engineering and Planning Education, Faculty of Engineering, Indonesia
*Corresponding Author: nuzululalifin@uny.ac.id

ARTICLE INFO

ABSTRACT

Background: The use of learning media is very influential in the learning process. In natural lighting calculation material, students usually use the Split Flux method, but the calculation is long because students have to provide a solar arc in the form of a printout on mica. So in this study, students will be divided into several groups to calculate natural lighting using an android-based lux meter.

Methods: The approach used in this research is a quantitative approach, with an empiricist paradigm, and with a survey method. The survey was conducted on students who had taken the Building Physics course. The survey was conducted using an instrument. The instrument is an open and closed questionnaire.

Results: The survey results show that (1) 73% of respondents chose the answer 51% to 75%, meaning that 73% of students understand the split flux method and 28% of respondents chose 75% to 100%, meaning that 28% of students understand the split flux method; (2) 78% stated that it was easier to use an android-based lux meter to measure natural lighting; (3) 79% stated that it was faster to use an android-based lux meter to measure natural lighting.

Conclusion: By using an android-based lux meter, students can install it on their respective handphone, besides students are facilitated in measuring natural or artificial lighting and are not paid, besides that the process is faster and more flexible by using the help of android-based lux meter media in Building Physics courses, students become more interested in learning natural lighting measurements because they can easily take lighting measurements in a room.

INTRODUCTION

In the Civil Engineering and Planning Education program, there is a course where the course studies the science of physical elements (temperature, sound, and light) that can affect the comfort of the users of the building, the course is the building physics course (Kenyo et al., 2022). Building Physics is a compulsory course that must be taken by students. This course is taken by students in semester 2, where this course consists of 1 credit of theory and 1 credit of practicum. One of the materials taught in this course is natural and artificial lighting.

Lighting is one of the factors in planning a room in a building to support user comfort. Lighting is divided into two, namely natural lighting and artificial lighting. Natural lighting is influenced by several factors, namely window opening design, room shape and depth, visual comfort, and external factors (Fleta, 2021). While artificial lighting is used to fulfil visual comfort, where there are two main parts, namely the primary lighting system and the secondary comfort system (Sutanto, 2018). The use of natural lighting (sunlight) can reduce the use of electrical energy, but the inconsistent availability of natural lighting sources can cause the distribution of light into the room to be uneven, so artificial lighting is needed (Azizah & Iyati, 2017).

To calculate the natural lighting in a room, a medium is needed, where initially students used the split flux method with the help of a solar arc, based on the results of a survey of students who had taken Building Physics courses, students found it difficult to make solar arcs because they had to be printed out using mica to find the SC value and use a monogram to find the IRC value. The split flux method is used to determine the average natural lighting of space instead of light per point (Ikhwanuddin, 2007). So the split flux method is one method used to see how much natural lighting intensity in a room.

Tools that can be used to support the learning process to convey messages to learners well are called learning media (Moto, 2019). Learning media can also be interpreted as a tool that can be used to convey messages or information during learning (Tambunan, 2021). A lesson that uses appropriate media will run effectively if the role of educators in learning acts as a facilitator and provides convenience to students in the learning process (Salim & Utama, 2020). The more relevant the learning media chosen, the more it will support in achieving effective, efficient, and meaningful learning objectives (Mansur et al., 2019). The selection of the right learning media is very influential in supporting student learning because it can help students to understand learning material, besides that from the learning media students get concrete experience (Wulandari et al., 2023). So that good learning media is learning media that can facilitate learners to be able to receive learning material easily.
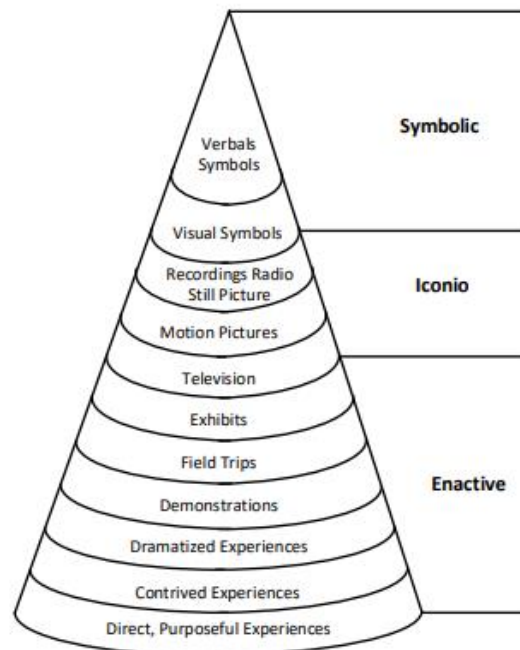
Figure 1. Dale's Cone of Experience

The cone above is a type of learning media based on Edgar Dale's theory (1969). In the cone image above, the real learning media has been arranged starting from the bottom, and the abstract learning media is located at the end of the cone (Marpanaji et al., 2018).

With the development of technology, learning media has also developed. Lux meter is a tool used to measure light intensity. However, the price of lux meters is relatively quite expensive so that android-based lux meters can be used as an alternative in measuring light intensity. Sumriddetchkajorn & Somboonkaew (2010) Specializing for the first time in mobile phone-based light measurement, the idea originated from a digital camera on a cell phone enabled for a two-dimensional light-sensitive device and the captured image can be made diffuse, so that the image can be correlated to the appropriate light level by the cell phone's internal microprocessor and specific algorithms embedded. The android-based Lux meter can store data, but it also uses a BH1750 light sensor that has a wider sensor range so that it can detect values up to 65536 lux (Ahmad et al., 2021). Nugroho et al., (2018) implementing the use of an android-based lux meter, the result is a high accuracy value of 99.53% in measuring 5w LED lights, while the lowest accuracy value in measuring 5w incandescent lamps is 63.11%.

In this study, a survey will be conducted on students who have taken Building Physics courses on the use of android-based lux meters used to measure natural lighting. It is hoped that students can more easily take measurements of natural lighting in a room.

METHODS

The approach used in this research is a quantitative approach, with an empiricist paradigm, and with a survey method. The survey method is a means of collecting data from sources, so that researchers can get the information needed in their research (Adiyanta, 2019). The survey method will produce statistical information, where researchers will ask several questions to respondents about their beliefs, opinions, characteristics, behaviors that have or are happening (Groves, 2010). The stages of the survey method can be seen in Figure 1.

What researchers do in the first stage is to build an instrument or list of questions that researchers will use to measure the variables to be studied. After the questionnaire was distributed to respondents, respondents read and answered by marking the questionnaire. Apart from using questionnaires, researchers also conducted interviews with respondents. Researchers recorded and recorded answers from respondents to complete the unanswered data from the questionnaire. When preparing the questionnaire, researchers have thought about how to process the data to be analyzed. During the interview, the researcher interviewed the respondents clearly to extract information from the respondents. In addition, researchers also provide illustrations such as providing concrete examples. The last stage carried out by researchers is collecting data and preparing data to be processed as data for statistical analysis (Groves et al., 2002).
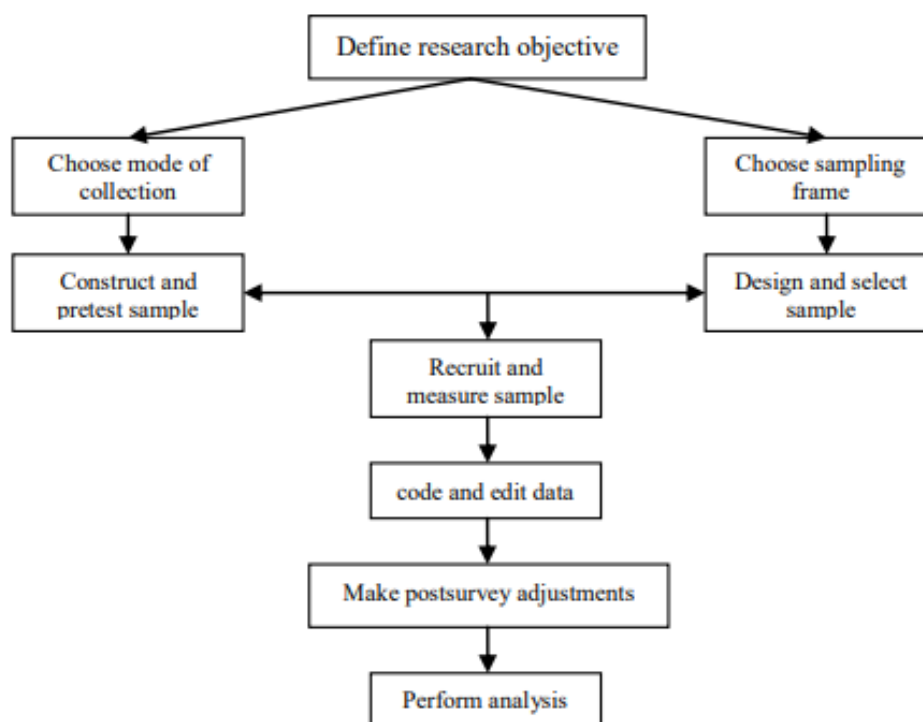

Figure 2. Steps of the Survey Method

The survey research method will take a sample of a population using a questionnaire as a data collection tool. (Adiyanta, 2019). The research data were obtained from primary data and secondary data. Primary data was obtained using instruments in the form of open and closed questionnaires through google form, while secondary data was obtained from literature studies. The survey was conducted on students of Civil Engineering and Planning Education. The sample used was 30 students who had taken the Building Physics course.

RESULTS AND DISCUSSION

Based on research conducted on Civil Engineering and Planning Education students who have taken Building Physics courses, the following primary data were obtained.

Questions regarding student perceptions of the split flux method. The result is 73% of respondents chose the answer 51% to 75%, meaning that 73% of students understand the split flux method and 28% of respondents chose 75% to 100%, meaning that 28% of students really understand the split flux method.
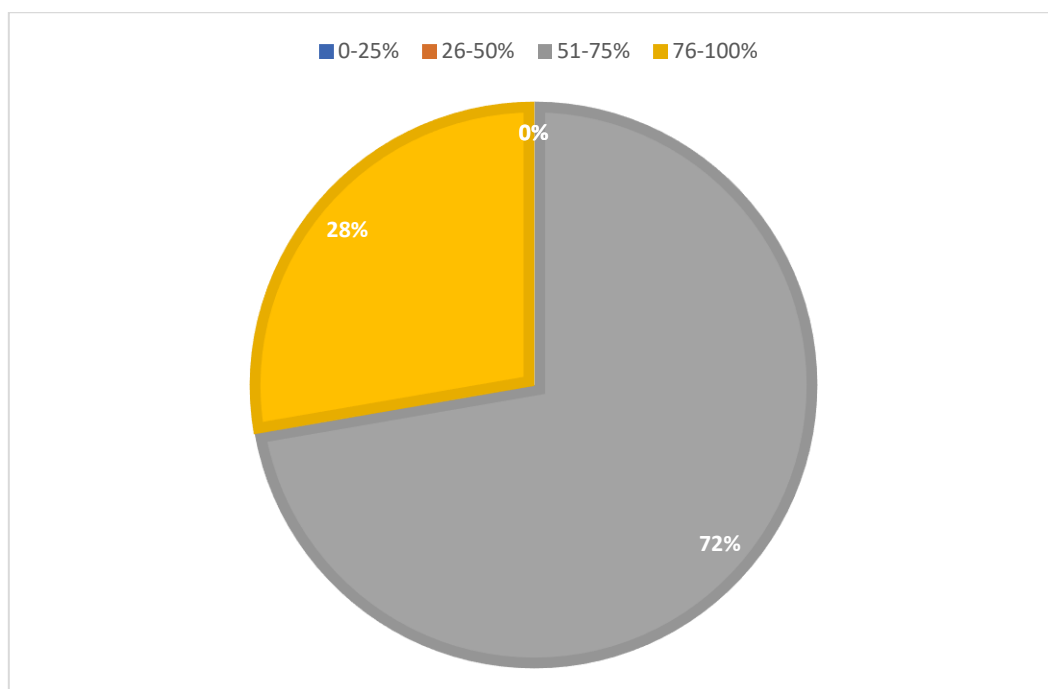

Figure 3. Students' perceptions of the split flux method

This is supported by the next question regarding the difficulties experienced by students when learning the split flux method, among others, because (1) the steps are long; (2) they must prepare a solar arc that is printed out on mica; (3) the printout of the solar arc must be clear because it is used for numerical accuracy; (4) not all photo copy places can print out on mica.

The next question is about which is easier between using an android-based lux meter or the split flux method. The result is 78% stated that it is easier to use an android-based lux meter.
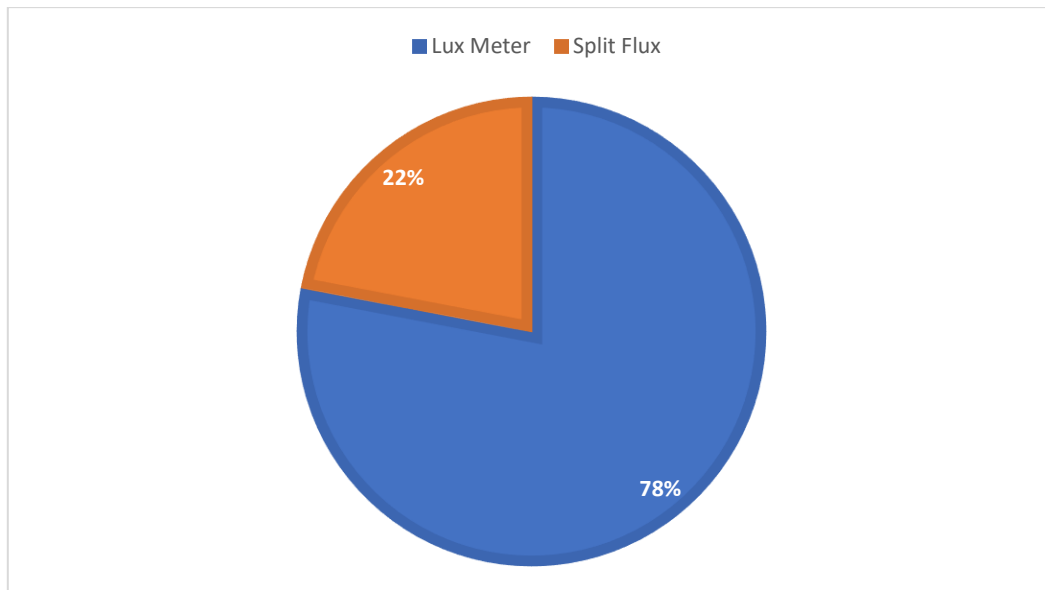

Figure 4. Ease between Android-based Lux Meter and Split Flux Method

The next question is about which is faster between using an android-based lux meter or the split flux method. The result is 79% stated that it is faster to use an android-based lux meter.
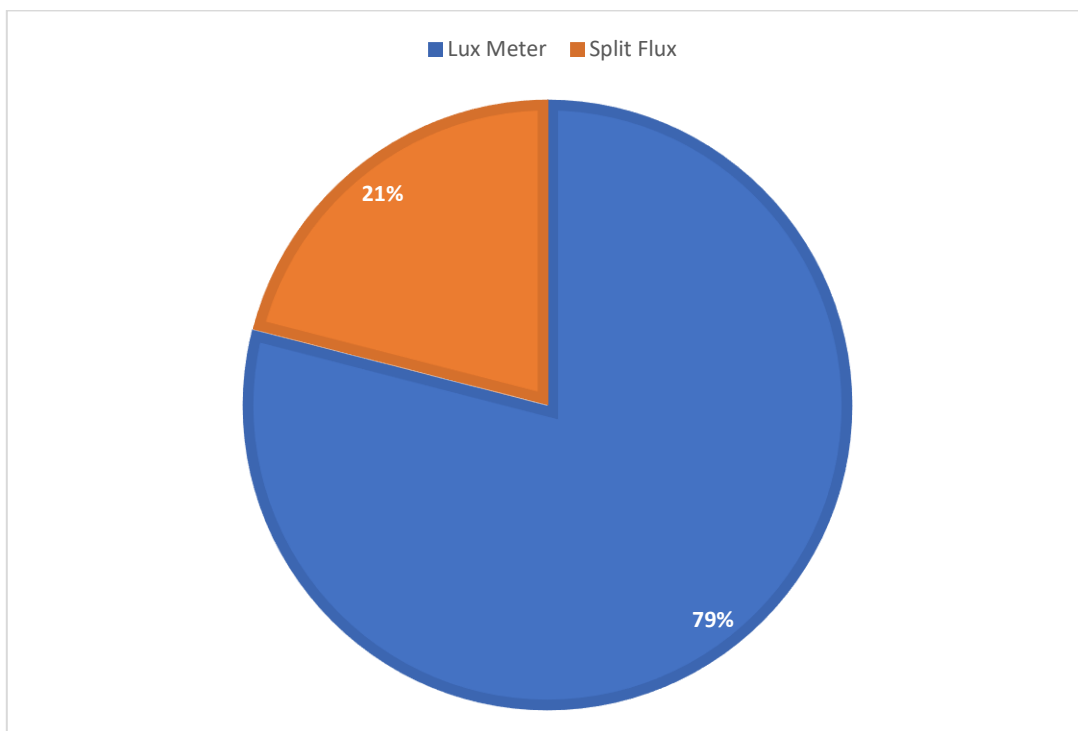

Figure 5. Speed between Android-based Lux Meter and Split Flux Method

This is supported by research conducted by (Ikhwanuddin, 2007), which states that in calculating natural lighting using the split flux method requires data on space components, such as ceiling area, walls, windows, floors, room area, besides that it requires solar arcs A and B to calculate SC (sky component) and requires a nomogram to calculate IRC (internally reflected component). Koenigsberger (1975) In the flux method, there are three components: SC (sky component), IRC (internally reflected component), and ERC (externally reflected component).

While the android-based lux meter is still easier and faster in calculating the intensity of natural lighting in a room, this happens because the application on android has advantages such as (1) user friendly in other words easy to operate in a short time; (2) open source, meaning that anyone can use without paying; (3) populist or can be operated in various circles; (4) support for various applications (Irsyad, 2016). But the use of applications on android also has disadvantages such as the reading cannot be used as an absolute reference, so it must be doubled with a digital lux meter, besides that it also requires space on a 5.48 MB in handphone. In addition, the angle of reception of the device light greatly affects the calculation of lux (Nugroho et al., 2018).

CONCLUSION

Based on the results above, it can be concluded that (1) 73% of respondents chose the answer 51% to 75%, meaning that 73% of students understand the split flux method and 28% of respondents chose 75% to 100%, meaning that 28% of students really understand the split flux method; (2) 78% stated that it was easier to use an android-based lux meter to measure natural lighting; (3) 79% stated that it was faster to use an android-based lux meter to measure natural lighting.

By using an android-based lux meter, students can install it on their respective handphone, besides that students are facilitated in measuring natural or artificial lighting and are not paid, besides that the process is faster and more flexible By using the help of android-based lux meter media in Building Physics courses, students become more interested in learning natural lighting measurements because they can easily take lighting measurements in a room.

REFERENCES

Adiyanta, F. C. S. (2019). Hukum dan Studi Penelitian Empiris: Penggunaan Metode Survey sebagai Instrumen Penelitian Hukum Empiris. *Administrative Law and Governance Journal*,

2(4), 697–709. https://doi.org/10.14710/alj.v2i4.697-709

Ahmad, M. D., Mohammad Noor, S. Z., Abdul Rahman, N. F., & Haris, F. A. (2021). Lux Meter Integrated with Internet of Things (IoT) and Data Storage (LMX20). *ICPEA 2021 - 2021 IEEE International Conference in Power Engineering Application*, *March*, 138–142. https://doi.org/10.1109/ICPEA51500.2021.9417762

Azizah, N., & Iyati, W. (2017). Manajemen Pencahayaan Alami dan Buatan pada Gedung Pascasarjana UNISMA. *Jurnal Mahasiswa Jurusan Arsitektur*, *5*(4), 1–8.

Fleta, A. (2021). Analisis Pencahayaan Alami dan Buatan pada Ruang Kantor Terhadap Kenyamanan Visual Pengguna. *Jurnal Patra*, *3*(1), 33–42. https://jurnal.idbbali.ac.id/index.php/patra

Groves, R. (2010). *Survey Methodology*. Op.cit.

Groves, R., Dillman, D., Eltinge, J., & Little, R. (2002). *Survey Nonresponse*. Wiley.

Ikhwanuddin. (2007). Perbandingan Metode Split Flux Dan Metoda Design Chart Dalam Perhitungan Cahaya Alami Ruang (DF). *INERSIA ...*, *3*(2), 54–63. https://journal.uny.ac.id/index.php/inersia/article/view/8330

Irsyad, H. (2016). *Aplikasi Android dalam 5 Menit*. PT Gramedia.

Kenyo, A. P., Ramadhan, M. A., & Murtinugraha, R. E. (2022). Pengembangan Bahan Ajar Fisika Bangunan Berbasis E-Module di Program Studi Pendidikan Teknik Bangunan. *Indonesian Journal Of Civil Engineering Education*, *8*(2), 62–71. https://doi.org/10.20961/ijcee.v8i2.70881

Koenigsberger, O. H. (1975). *Manual of Tropical Housing & Building*. Orient Blackswan.

Mansur, H., Utama, A. H., & Irianti, E. (2019). The Development of Ecosystem Education Game Product to Improve Learning Motivation Of 5 th Grade Students in Elementary School. *International Conference on Education Technology (ICoET) Advances in Social Science, Education and Humanities Research*, *372*, 207–211.

Marpanaji, E., Mahali, M. I., & Putra, R. A. S. (2018). Survey on How to Select and Develop Learning Media Conducted by Teacher Professional Education Participants. *Journal of Physics: Conference Series*, *1140*. https://doi.org/10.1088/1742-6596/1140/1/012014

Moto, M. M. (2019). Pengaruh Penggunaan Media Pembelajaran dalam Dunia Pendidikan. *Indonesian Journal of Primary Education*, *3*(1), 20–28. https://doi.org/10.17509/ijpe.v3i1.16060

Nugroho, P., Wijayanto, I., & Susatio, E. (2018). Perancangan dan Implementasi Aplikasi Light Meter pada Smartphone Berbasis Android. *E-Proceeding of Engineering*, *5*(2), 2214–2219.

Salim, A., & Utama, A. H. (2020). Evaluasi Sumatif Ketepatan Pemilihan Media Pembelajaran

Tepat Guna di Sekolah Dasar (SD) Se-Kota Banjarmasin. *Penelitain Tindakan Dan Pendidikan*, 6(2), 71–78. https://rumahjurnal.net/ptp/article/download/886/561

Sumriddetchkajorn, S., & Somboonkaew, A. (2010). Low-Cost Cell Phone-based Digital Lux Meter. *Advanced Sensor Systems and Applications IV*, 7853. https://doi.org/10.1117/12.870176

Sutanto, H. (2018). *Desain Pencahayaan Buatan Dalam Arsitektur*. Penerbit PT Kanisius.

Tambunan, S. A. (2021). Analisa Kebutuhan Pengembangan Media Pembelajaran pada Mata Pelajaran Konstruksi dan Utilitas Gedung di Kelas Desain Permodelan Dan Informasi Bangunan SMK Negeri 1 Percut Sei Tuan. *Jurnal Pendidikan Teknik Sipil*, 3(1), 23–27. https://doi.org/10.21831/jpts.v3i1.41883

Wulandari, A. P., Salsabila, A. A., Cahyani, K., Nurazizah, T. S., & Ulfiah, Z. (2023). Pentingnya Media Pembelajaran dalam Proses Belajar Mengajar. *Journal on Education*, 5(2), 3928–3936. https://doi.org/10.31004/joe.v5i2.1074