Momentum: Physics Education Journal
7 (1), 2023, 107-115
Available at: ejournal.unikama.ac.id/index.php/momentum
ISSN 2548-9127(print) | 2548-9135 (online)

Student's need analysis in using ordinary differential equation e-module of Mathematical Physics II

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Received: 26 June 2022; Revised: 7 January 2023; Accepted: 17 January 2023

Abstract: The purpose of this research is to find out students' opinion about e-module ordinary differential equations that will be developed. This type of research is a mixed method with the purposive sampling technique. The samples were 50 students of Universitas Jambi majoring physics education a regular class A and regular class B 2020 who took the mathematical physics II course. The data were collected through interviews and questionnaires, then analyzed using descriptive statistics for the questionnaires and Miles and Huberman's analysis for the interview results. The findings show that the majority of the students believe the creation of this e-module is a very good idea. This is proven by the results of descriptive statistics, where the average value is 18.0 and is in the required category. The quantitative findings are strengthened by the qualitative ones from interview, which show that the majority of respondents support the creation of this e-module. The results indicate that the students require additional learning resources to fully comprehend the lessons in the Mathematical Physics II e-module. Students can learn independently in mathematical physics course by using e-modules. The future studies on mathematical physics e-modules can use this study as a guide.
Keywords: E-Module; Mathematical Physics; Ordinary Differential Equations

How to Cite: Darmaji, D., Astalini, A., Kurniawan, D. A., Putri, F. I., Perdana, R., & Fuldiaratman, F. (2023). Student's need analysis in using ordinary differential equation e-module of Mathematical Physics II. *Momentum: Physics Education Journal*, 7(1), 107-115. https://doi.org/10.21067/mpej.v7i1.7092

Introduction

As the years go by, all aspects of life are also thriving in terms of social, cultural, economic, art, and information and communications technology (Butyrina et al., 2022; Cueva & Inga, 2022; Sopacua et al., 2020). Developments in information technology and communication are by far the most rapid developments in the present era and are inevitably the effects on education (Bruschi et al., 2021; Guàrdia et al., 2021; Stojanović et al., 2020). In the world of education, the dissemination of information technology will cause the transformation of scientific learning into a much easier and faster kind of transformation (Dalkiliç et al., 2017; Utéza & Reffay, 2021; Xu & Waniganayake, 2018). One of the roles of technology in the learning process has been used extensively by educators with renewed efforts. Multiple efforts must continue to improve the learning process (Johan et al., 2022; Maksum & Purwanto, 2022; Rote, 2017). One of the efforts that can be made to enhance the quality of learning is to develop the learning media of teaching materials (Alenezi & Brinthaupt, 2022; Bice et al., 2019; Kumpikaite, 2008).

The development of the resource for the learning process is essential in improving the quality of the learning process, so that learners can understand concepts through the developed media and can learn on their own (Dawson, 2010; B. Williamson et al., 2019; et al., 2006). Modern technological sophistication could be used for educators to develop teaching media based on these electronic

DOI: 10.21067/mpej.v7i1.2023

modules (McNamara & Shapiro, 2005; Tamrongkunanan & Tanitteerapan, 2020; D. Williamson, 2001). With e-module development and a rapidly expanding technological development, students can access the learning materials through their smartphones.

An electronic module is an electronic book that was created for students to study on their own, either with or without the guidance of the teacher (Barr & Jackson, 2018; Sofyan et al., 2019). The e-modules give many advantages compared to the print module. One of which is its interactive nature that makes it easier to navigate (Darmaji, Kurniawan, et al., 2020; Grabinski et al., 2020; Li et al., 2016). The electronic module is interactive, meaning that it is a module made systematically and of course interesting by both the description of matter, the learning method, and the way to evaluate for desired competence (Chongo et al., 2021; Farihah et al., 2023; Fortner et al., 2016). Thus these interactive modules can be used in learning (Azid & Md-Ali, 2020; Li et al., 2016; Patel et al., 2018). One of the subjects that so desperately need the development of an interactive e-module material is a mathematical physics.

Mathematical physics is a subject matter that studies how to formulate concepts of physics into mathematical forms and how to solve them (Jufrida et al., 2019; Oyedeji, 2017). Mathematical physics is also a required subject of the study of physics at the Faculty of Teacher Training and Education Science (FKIP) of Universitas Jambi. Many students find it difficult to achieve satisfying results in college since most of whom think that learning media as well as foreign-language may also be part of the problem in understanding material (Astalini et al., 2019; Laurens et al., 2018; Torbjörnsson et al., 2018). Difficulties are also experienced in understanding textbooks of mathematical physics that use English language such as "Mathematical Method in the Physical Sciences" due to a lack of understanding of English. This becomes a double burden of mastering English as an introduction to basic learning and competence, to questionable learning achievement (Ng, 2019). Therefore, researchers are encouraged to develop e-module materials that can be used by physics students in mathematical physics II courses to make it easier for students to understand the material in learning and improve students' mathematical abilities in problem solving skills to master the mathematical physics.

E-modules for mathematical physics II courses need to be assessed for their needs in order to conduct a preliminary investigation as part of the author's research. The purpose of the preliminary study is to identify the characteristics of the population that will be further studied (Jusoff & Khodabandelou, 2009). In contrast to earlier studies, the majority of preliminary studies are very infrequently carried out. Considering the previous description, the objectives of this study are to: (1) describe the degree to which students need the ordinary differential equations e-module for physics mathematics course II; and (2) describe students' opinions of the e-module of ordinary differential equations for physics mathematics course II.

Method

A mixed method was involved. Mixed method is a study that combines qualitative research with quantitative research (Byrne & Humble, 2007; Rai & Thapa, 2015). The study was conducted at Universitas Jambi in accordance with the university's advanced physics course. The population in this study is the students of FKIP Universitas Jambi year 2020 who take physics course. About 50 students were taken as the sample of this study since the sample forms part of the population that is designated a research subject and is expected to represent the population (Mazen & Tong, 2020).The number of samples established by researchers is 45 students on the subject of questionnaire distribution and 5 students on the subject of interviews. Purposive sampling is the method of sampling that was applied. Purposive sampling is used to acquire research subjects based on special consideration of the research needs (Campbell et al., 2020; Guarte & Barrios, 2006). Sample collecting was established with the criteria that students who were taking mathematical physics II in the fourth semester and that students had basic knowledge of how to use a laptop or mobile phone to study.

The data in this study were obtained from quantitative data obtained using a questionnaire and qualitative data obtained from interviews (Rintakorpi & Reunamo, 2017; Tölle et al., 2019). The questionnaire used in the study was the student's need for the electronic module of ordinary

differential equations in the mathematical physics course II with 6 statements to analyze the material used and to be developed. Data collection was carried out using a Google Form questionnaire by answering the questions that had been given. While interviews were conducted with students by giving 12 questions. Table 1 below is a student needs questionnaire instrument.

Table 1. Grid of the student needs questionnaire instrument

Indicator	No. Statement
Material Difficulity	1
Condition of the media used	2, 3, 4, 5, 6

The questionnaire used in the research was drawn from the Likert scale. The student ratings had a different score: strongly agree to score 4, agree to score 3, disagree to score 2, and strongly disagree to score 1. As for the criteria of the given student needs, it can be seen on the following Table 2:

Table 2. The student range and scoring criteria needs on the e-module of mathematical physics II

Interval	Category
6.0-10.5	Strongly disagree
10.6-15.0	Disagree
15.1-19.5	Agree
19.6-24.0	Strongly agree

Based on Table 2, it can be seen that the student ratings are strongly disagree, disagree, agree, and strongly agree with the score intervals that were searched before. Researchers also conducted interviews using interview guidelines. Interview guidelines can be seen in the following Table 3:

Table 3. Grid of student interview instruments

No	Indicator	No. Item
1	Following the process of mathematics physics lectures II	1, 2, 3
2	Teaching materials used in lectures	4, 5
3	Constraints in lectures	6, 7
4	Solutions expected by lecture participants	8
5	What sort of module will the participants in the lecture expect if one is created?	9, 10, 11, 12

Questionnaire data analysis conducted by researchers using descriptive statistics. Descriptive statistics are data analysis that is carried out by describing quantitative data or information (Fisher & Marshall, 2009; Kaur et al., 2018) by looking for the average, median, minimum and maximum values to get an overview of the characteristics of the data (Darmaji, Astalini, et al., 2020). Tests in this study were carried out with the help of the IBM SPSS 25 program. Meanwhile, the analysis of the interview data consisted of three main activities, namely the reduction of the data obtained, the presentation of the data obtained, and drawing conclusions or verification.

Results and Discussion

Here's the description chart for the achievement of physics education students' need for the development of the e-module of mathematical physics II in 2020 class. Table 4 displays the findings of descriptive statistical tests on the degree of students' needs for the e-module ordinary differential equations.

Table 4. Results of descriptive statistical tests on the degree to which students need electronic modules in ordinary differential equations

Category	F	%	Mean	Med	Min	Max
Strongly disagree	0	0				
Disagree	7	14.0	18.0	18.0	13.0	24.0
Agree	31	62.0				
Strongly agree	12	43.0				

Based on Table 4 it is known that physics education students who answered in the agree category to develop the physics mathematics e-module II were as many as 31 students with a percentage of 62.0%. Whereas other students responded to the strongly agree category of 12 students, and only 7 in the disagree category. The average student response to the mathematics physics e-module II was 18.0 with a median value of 18.0. The minimum score was 13.0 and the maximum value is 24.0.

Thus it can be seen that most students agree with the development of e-modules as material for mathematical physics II to make it easier to understand, because the use of English is considered difficult for students. This is supported by research which shows that a lack of mastery of English, both for teachers and students, in learning can make learners bear a double burden which leads to questionable learning achievement. While learning mathematical physics requires student integration both conceptually and mathematically, because one of the goals of this course is to make students able to formulate a physics process into a mathematical statement. This lesson is also designed to prepare students to master mathematical analytical technique material from physics concepts.

Once quantitative data had been collected, researchers also collected qualitative data obtained from interviews. Interview results are used to support quantitative data results found. As for the results of the interview obtained are the students claiming that e-module development on this second course of mathematical physics was needed. The outcomes of the following interviews demonstrate this :

1. Q: Are you studying Mathematical physics II?
   A: Yes
2. Q: Is this your first class on mathematical physics II?
   A: yes.
3. Q: How many times have you attended Mathematical physics II?
   A: once (a semester).
4. Q: Do you have any literature on Mathematical physics II?
   A: yes, I do.
5. Q: What do you think of the literature used in the lecture on mathematical physics II?
   A: it is difficult to understand, since a book or source of instruction is used in English.
6. Q: Did you have obstacles or problems during Mathematical Physics II?
   A: yes, there are obstacles.
7. Q: Did one of the obstacles or problems during Mathematical physics II college lie in the teaching material?
   A: yes.
8. Q: What do you expect from Mathematical Physics II?
   A: may there be an Indonesian book and developed with detailed examples of formula problems and descriptions that students can readily understand.
9. Q: Would you prefer if Mathematics II were presented as an electronic module?
   A: yes, very happy.
10. Q: What would you think if Mathematical Physics II was built as an electronically based college module?
    A: strongly agree, as it makes it easier for students to study material.
11. Q : If there is an electronic module of mathematical physics II, do you think that could help teach math physics II?
    A: yes, very helpful.
12. Q: What would you anticipate from a mathematical physics II electronic module if one existed?

A: hopefully, the resulting electronic modules use Indonesia to help us understand the material with detail.

Based on the analysis of student interviews, it can be concluded that students need additional teaching materials in class mathematical physics II, especially Indonesian. However, material selection cannot be the only reason. Good and interesting teaching is one of the considerations in learning (Albanese et al., 2010; Barr & Jackson, 2018). Good teaching materials can be used to help students achieve the expected competencies (Buckingham, 2013; Roldán-Zafra et al., 2022). Meanwhile, interesting teaching materials are needed so that students are more enthusiastic and more interested in learning the material, both in terms of appearance and content.

Students expect varied teaching materials with an attractive appearance in Indonesian, and various examples of questions with more detailed formula derivations to make them easier to understand. However, teaching materials presented in the form of electronic modules will make students feel happy because students can read the e-modules anytime and anywhere without the hassle of carrying thick books. They only need to access the smartphone to be able to read it and study it so that it supports lectures (Charlina et al., 2022; Rahman et al., 2022).

In essence, this research is an early stage in the manufacture of instructional media. For writers who want to understand the characteristics of the sample population, this research is very helpful. In addition, preliminary analysis helps researchers in making plans that will later be implemented in the development of learning media. This research is also beneficial for students to understand how important it is to use media for learning, especially physics, so they can assess their learning challenges. Teachers can use this research to learn more about the characteristics of classroom learning, which can then be applied to selecting the best learning resources for more efficient learning.

One of the required courses in at Physics Education Study Program in Universitas Jambi is mathematical physics. Every student should learn and understand mathematical physics because it serves as the foundation for more advanced physics courses. The ability to apply a variety of fundamental mathematical techniques to a variety of simple physics problems is the course's final expected skill analytically. Ordinary Differential Equations are very important for students to learn because they are the basic concept of applying an everyday occurrence that uses the concept of derivative of a function correctly. Therefore, a clear construction scheme is necessary to learn about the derivative concept of a function (Santos et al., 2020).

Because it is the first step in the development of electronic modules, this research is regarded as being of utmost importance to students. The use of e-modules generally tends to be appropriate for abstract subject matter like physics, especially mathematical physics courses. E-modules themselves have a number of advantages over printed modules (Astalini et al., 2021; Charlina et al., 2022; Rahman et al., 2022). The e-modules can be accessed for a prolonged period and does not need as much maintenance. To prevent damage to the print module, it needs to be cleaned. Because print modules cannot include things like video, sound, or animation, they are typically less interactive than e-modules.

It is hoped that this research can contribute reference material in mathematical physics II lectures and be able to overcome student difficulties in learning. Further research can be conducted to determine the results and feasibility of developing the e-module of mathematical physics II.

Conclusion

Considering the results that have been obtained, the researcher stated that ordinary differential equations are needed in studying mathematical physics II. The data is also strengthened by interviews which show that the e-module needs to be developed because previously the main source was mostly in full English. Based on the results and discussion, it can be concluded that the e-module of ordinary differential equations in the mathematics physics II course is very important to develop.

References

Albanese, M. A., Mejicano, G., Anderson, W. M., & Gruppen, L. (2010). Building a competency-based curriculum: The agony and the ecstasy. *Advances in Health Sciences Education*, *15*(3), 439–454. https://doi.org/10.1007/s10459-008-9118-2

Alenezi, W., & Brinthaupt, T. M. (2022). The Use of Social Media as a Tool for Learning: Perspectives of Students in the Faculty of Education at Kuwait University. *Contemporary Educational Technology*, *14*(1), 1–18. https://doi.org/10.30935/cedtech/11476

Astalini, A., Darmaji, D., Kurniawan, D. A., & Chen, D. (2021). Investigating Student Perceptions Based on Gender Differences Using E-Module Mathematics Physics in Multiple Integral Material. *Jurnal Pendidikan Sains Indonesia*, *9*(4), 602–619. https://doi.org/10.24815/jpsi.v9i4.21297

Astalini, Kurniawan, W., Anwar, K., & Kurniawan, D. A. (2019). Effectiveness of Using E-Module and E-Assessment. *International Journal of Interactive Mobile Technologies*, *13*(9), 21–39. https://doi.org/10.3991/ijim.v13i09.11016

Azid, N., & Md-Ali, R. (2020). The effect of the successful intelligence interactive module on universiti utara malaysia students' analytical, creative and practical thinking skills. *South African Journal of Education*, *40*(3), 1–11. https://doi.org/10.15700/saje.v40n3a1743

Barr, M., & Jackson, L. H. (2018). Enhancing Delivery and Assessment: A Case Study in Module Redesign for Improved Transition Into Higher Education. *Journal of Political Science Education*, *14*(3), 390–399. https://doi.org/10.1080/15512169.2017.1415812

Bice, M. R., Ball, J. W., Hollman, A., & Adkins, M. (2019). Health Technology Use: Implications for Physical Activity Behaviors Among College Students. *International Journal of Kinesiology in Higher Education*, *3*(1), 23–34. https://doi.org/10.1080/24711616.2018.1516524

Bruschi, B., Floris, F., Marchisio, M., & Sacchet, M. (2021). Lesson Learned From an Experience of Teaching Support in Higher Education for a Digital Transition in the New Scenario Created By Covid-19. *18th International Conference on Cognition and Exploratory Learning in Digital Age, CELDA 2021*, 276–283. https://doi.org/10.33965/celda2021_202108l034

Buckingham, D. (2013). Teaching the creative class? Media education and the media industries in the age of "participatory culture." *Journal of Media Practice*, *14*(1), 25–41. https://doi.org/10.1386/jmpr.14.1.25_1

Butyrina, M., Hyrina, T., Penchuk, I., Bondarenko, I., Skurtul, G., & Tiapkina, N. (2022). The Development of Innovative Media Education Styles in the Era of Information and Communication Technologies. *Journal of Curriculum and Teaching*, *11*(1), 195–207. https://doi.org/10.5430/jct.v11n1p195

Byrne, J., & Humble, Á. M. (2007). An Introduction to Mixed Method Research. *Atlantic Research Centre for Family-Work Issues*, *December*(January 2006), 1–4. http://www.msvu.ca/site/media/msvu/MixedMethodologyHandout.pdf

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: complex or simple? Research case examples. *Journal of Research in Nursing*. https://doi.org/10.1177/1744987120927206

Charlina, C., Septyanti, E., Mustika, T. P., & Rahmi, A. (2022). Electronic module as learning needs to write exposition texts for junior high school students. *Journal of Education and Learning (EduLearn)*, *16*(2), 219–225. https://doi.org/10.11591/edulearn.v16i2.20402

Chongo, S., Osman, K., & Nayan, N. A. (2021). Impact of the Plugged-in and Unplugged Chemistry Computational Thinking Modules on Achievement in Chemistry. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(4), 1–21. https://doi.org/10.29333/ejmste/10789

Cueva, A., & Inga, E. (2022). Information and Communication Technologies for Education Considering the Flipped Learning Model. *Education Sciences*, *12*(3), 1–16. https://doi.org/10.3390/educsci12030207

Dalkiliç, F., Ankan, E., Çabuk, U. C., & Gürkan, A. (2017). An analysis of the positioning accuracy of iBeacon technology in indoor environments. *International Conference on Computer Science and Engineering*, 549–553. https://doi.org/10.1109/UBMK.2017.8093459

Darmaji, D., Astalini, A., Kurniawan, D. A., Ningsi, A. P., Romadona, D. D., & Dari, R. W. (2020). Regression of Science Process Skills On Critical Thinking Skills In Two Junior High Schools In Jambi City. *JIPF (Jurnal Ilmu Pendidikan Fisika)*, *5*(3), 177–186. https://doi.org/10.26737/jipf.v5i3.1788

Darmaji, D., Kurniawan, D. A., Astalini, A., Winda, F. R., Heldalia, H., & Kartina, L. (2020). The Correlation Between Student Perceptions of the Use of E-Modules with Students' Basic Science Process Skills. *JPI (Jurnal Pendidikan Indonesia)*, *9*(4), 719. https://doi.org/10.23887/jpi-undiksha.v9i4.28310

Dawson, S. (2010). "Seeing" the learning community: An exploration of the development of a resource for monitoring online student networking. *British Journal of Educational Technology*, *41*(5), 736–752. https://doi.org/10.1111/j.1467-8535.2009.00970.x

Farihah, Tanjung, S., Ampera, D., Sitompul, H., & Jahidin, I. (2023). Development of 3D-based Learning Modules for University Students. *International Journal of Education in Mathematics, Science and Technology*, *11*(1), 56–73. https://doi.org/10.46328/ijemst.2715

Fisher, M. J., & Marshall, A. P. (2009). Understanding descriptive statistics. *Australian Critical Care*, *22*(2), 93–97. https://doi.org/10.1016/j.aucc.2008.11.003

Fortner, S. K., Scherer, H. H., & Murphy, M. A. (2016). Engaging undergraduates in soil sustainability decision-making through an InTeGrate module. *Journal of Geoscience Education*, *64*(4), 259–269. https://doi.org/10.5408/15-106.1

Grabinski, K., Kedzior, M., Krasodomska, J., & Herdan, A. (2020). Embedding e-learning in accounting modules: The educators' perspective. *Education Sciences*, *10*(4). https://doi.org/10.3390/educsci10040097

Guàrdia, L., Clougher, D., Anderson, T., & Maina, M. (2021). IDEAS for Transforming Higher Education: An Overview of Ongoing Trends and Challenges. *International Review of Research in Open and Distance Learning*, *22*(2), 167–184. https://doi.org/10.19173/irrodl.v22i2.5206

Guarte, J. M., & Barrios, E. B. (2006). Estimation under purposive sampling. *Communications in Statistics: Simulation and Computation*, *35*(2), 277–284. https://doi.org/10.1080/03610910600591610

Johan, R. C., Rullyana, G., & Ardiansah, A. (2022). Hyper content e-module in information behavior course with the assistant of screencast. *Journal of Education and Learning (EduLearn)*, *16*(2), 210–218. https://doi.org/10.11591/edulearn.v16i2.20339

Jufrida, J., Kurniawan, W., Astalini, A., Darmaji, D., Kurniawan, D. A., & Maya, W. A. (2019). Students' attitude and motivation in mathematical physics. *International Journal of Evaluation and Research in Education*, *8*(3), 401–408. https://doi.org/10.11591/ijere.v8i3.20253

Jusoff, K., & Khodabandelou, R. (2009). Preliminary Study on the Role of Social Presence in Blended Learning Environment in Higher Education. *International Education Studies*, *2*(4), 79–83. https://doi.org/10.5539/ies.v2n4p79

Kaur, P., Stoltzfus, J., & Yellapu, V. (2018). Descriptive statistics. *International Journal of Academic Medicine*, *4*(1), 60–63. https://doi.org/10.4103/IJAM.IJAM

Kumpikaite, V. (2008). Human resource development in learning organization. *Journal of Business Economics and Management*, *9*(1), 25–31. https://doi.org/10.3846/1611-1699.2008.9.25-31

Laurens, T., Batlolona, F. A., Batlolona, J. R., & Leasa, M. (2018). How does realistic mathematics education (RME) improve students' mathematics cognitive achievement? *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(2), 569–578. https://doi.org/10.12973/ejmste/76959

Li, W., Cashell, A., Jaffray, D. A., & Moseley, D. (2016). Development and Implementation of an Electronic Learning Module for Volumetric Image-Guided Radiation Therapy. *Journal of Medical Imaging and Radiation Sciences*, *47*, 43–48. https://doi.org/10.1016/j.jmir.2015.12.001

Maksum, H., & Purwanto, W. (2022). The Development of Electronic Teaching Module for Implementation of Project-Based Learning during the Pandemic. *International Journal of Education in Mathematics, Science and Technology*, *10*(2), 293–307. https://doi.org/10.46328/ijemst.2247

Mazen, J. A. M., & Tong, X. (2020). Bias Correction for Replacement Samples in Longitudinal Research. *Multivariate Behavioral Research*, *0*(0), 1–23. https://doi.org/10.1080/00273171.2020.1794774

McNamara, D. S., & Shapiro, A. M. (2005). Multimedia and hypermedia solutions for promoting metacognitive engagement, coherence, and learning. *Journal of Educational Computing Research*, *33*(1), 1–29. https://doi.org/10.2190/7N6R-PCJL-UMHK-RYPJ

Ng, W. (2019). A partnership-designed online module on climate science: Impact on year 10 teachers and students. *Eurasia Journal of Mathematics, Science and Technology Education*, *15*(2). https://doi.org/10.29333/ejmste/100638

Oyedeji, S. O. (2017). The Effects of Students' Motivational Factors on their Attitudes toward Mathematics. *International Journal of Evaluation and Research in Education (IJERE)*, *6*(4), 277–287. https://doi.org/10.11591/ijere.v6i4.10770

Page, T., & Thorsteinsson, G. (2006). An Evaluation Of Electronic Product Design Education Using Hypermedia-Resourced Learning Environments. *I-Manager's Journal of Educational Technology*, *3*(3), 42–47. https://doi.org/10.26634/jet.3.3.707

Patel, S. R., Margolies, P. J., Covell, N. H., Lipscomb, C., & Dixon, L. B. (2018). Using Instructional Design, Analyze, Design, Develop, Implement, and Evaluate, to Develop e-Learning Modules to Disseminate Supported Employment for Community Behavioral Health Treatment Programs in New York State. *Frontiers in Public Health*, 113. https://doi.org/10.3389/fpubh.2018.00113

Rahman, A., Wibawa, B., & Sumantri, S. (2022). Develop English Electronic Module for Tourism Through Analysis of Learner's and Context. *Education Quarterly Reviews*, *5*(1), 48–57. https://doi.org/10.31014/aior.1993.05.01.417

Rai, N., & Thapa, B. (2015). A study on purposive sampling method in research. *Kathmandu:Kathmandu School of Law*, 1–12. http://stattrek.com/survey-research/sampling-methods.aspx?Tutorial=AP,%0Ahttp://www.academia.edu/28087388

Rintakorpi, K., & Reunamo, J. (2017). Pedagogical documentation and its relation to everyday activities in early years. *Early Child Development and Care*, *187*(11), 1611–1622. https://doi.org/10.1080/03004430.2016.1178637

Roldán-Zafra, J., Perea, C., Polo-Blanco, I., & Campillo, P. (2022). Design of an Interactive Module Based on the van Hiele Model: Case Study of the Pythagorean Theorem. *International Electronic Journal of Mathematics Education*, *17*(1), em0672. https://doi.org/10.29333/iejme/11556

Rote, A. E. (2017). Physical activity intervention using Fitbits in an introductory college health course. *Health Education Journal*, *76*(3), 337–348. https://doi.org/10.1177/0017896916674505

Santos, L. B., Xavier, P. H. F., Santos, J. V. C., & Sampaio, R. R. (2020). Teaching of ordinary differential equations using the assumptions of the PBL method. *International Journal of Engineering Pedagogy*, *10*(3), 7–20. https://doi.org/10.3991/IJEP.V10I3.12015

Sofyan, H., Anggereini, E., & Saadiah, J. (2019). Development of E-Modules Based on Local Wisdom in Central Learning Model at Kindergartens in Jambi City. *European Journal of Educational Research*, *8*(4), 1137–1143. https://doi.org/10.12973/eu-jer.8.4.1137

Sopacua, J., Fadli, M. R., & Rochmat, S. (2020). The history learning module integrated character values. *Journal of Education and Learning (EduLearn)*, *14*(3), 463–472. https://doi.org/10.11591/edulearn.v14i3.16139

Stojanović, D., Bogdanović, Z., Petrović, L., Mitrović, S., & Labus, A. (2020). Empowering learning process in secondary education using pervasive technologies. *Interactive Learning Environments*, 1–14. https://doi.org/10.1080/10494820.2020.1806886

Tamrongkunanan, T., & Tanitteerapan, T. (2020). Development of required knowledge and skills among students through applied learning modules. *International Journal of Instruction*, *13*(4), 695–714. https://doi.org/10.29333/iji.2020.13443a

Tölle, T. R., Baron, R., de Bock, E., Junor, R., Dias Barbosa, C., Marshall, S. F., Arnould, B., & Freynhagen, R. (2019). painPREDICT: first interim data from the development of a new patient-reported pain questionnaire to predict treatment response using sensory symptom profiles. *Current Medical Research and Opinion*, *35*(7), 1177–1185. https://doi.org/10.1080/03007995.2018.1562687

Torbjörnsson, E., Olivecrona, C., & Sonden, A. (2018). An interprofessional initiative aimed at creating a common learning resource for the operating room ward. *Journal of Interprofessional Care*, *32*(4), 501–504. https://doi.org/10.1080/13561820.2018.1435516

Utéza, M., & Reffay, C. (2021). Distance learning in the time of covid-19 lockdown: New opportunities for information and communication technologies in education? *8th International Conference on Educational Technologies 2021, ICEduTech 2021 and 17th International Conference on Mobile Learning 2021, ML 2021*, 91–98. https://doi.org/10.33965/ml_icedutech2021_202102l012

Williamson, B., Potter, J., & Eynon, R. (2019). New research problems and agendas in learning, media and technology: the editors' wishlist. *Learning, Media and Technology*, *44*(2), 87–91. https://doi.org/10.1080/17439884.2019.1614953

Williamson, D. (2001). Library and academic collaboration: A case study in teaching media communications. *Australian Academic and Research Libraries*, *32*(1), 53–60. https://doi.org/10.1080/00048623.2001.10755143

Xu, Y., & Waniganayake, M. (2018). An exploratory study of gender and male teachers in early childhood education and care centres in China. *Compare: A Journal of Comparative and International Education*, *48*(4), 518–534. https://doi.org/10.30809/phe.1.2017.21