learning model is a description of the mental and physical mechanisms that are involved in the acquisition of new skills and knowledge and how to engage those mechanisms to encourage and facilitate learning" [7]. Accordingly, learning models help teachers create an organized system of planning learning activities and creating an appropriate learning environment. Therefore, it influences what the teacher does, what the students do, the type of learning environment that takes place, and the selection of instructional materials. One of the current constructivist-based learning models is the 7E learning model, an expansion of the 5E Instructional Learning model developed in 1987 by the Biological Sciences Curriculum Study that has been widely applied in the education of teaching practices its inception. The 7E model was proposed by Eisenkraft [8] that emphasizes eliciting prior understanding and transfer of knowledge; thus, the other two stages are added to the existing model. The addition of the different two phases is to make sure that teachers will attend to all the critical elements of learning and meet all the learning model requirements. Eisenkraft [8] emphasized that the goal of the 7E model is to "emphasize the increasing importance of eliciting prior understanding and the extending, or transfer of concepts." Eliciting prior understanding is a necessary component of the learning process according to cognitive science, while the transfer of learning (extend stage) is required in good instruction as manifested by expert learners who are more adept in this phase than novice learners. Thus, the different stages or phases of the 7E learning model are; elicit, engage, explore, explain, elaborate, evaluate, and extend.

Duran and Duran [9] emphasized the importance of a learning model in the classroom, particularly in science education. They argued that using such a model "helps to facilitate inquiry practices because learning cycles focus on constructivist principles and emphasize the explanation and investigation of phenomena, the use of evidence to back up conclusions, and experimental design." Several studies on the use of the 7E learning model in science education have shown to improve students' cognitive achievement [10], skill acquisition, or improvement [11] and attitude towards science [12]. Balta and Sarac [13], on their meta-analysis study on the effect of the 7E learning cycle and other preceding models on science education, could be categorized into knowledge, skill, and attitude domains.

One of the 7E instructional model's critical features is that it consists of activities at every stage that requires a student's curiosity and active use of skills and prior knowledge. As explained by the model, "brings coherence to different teaching strategies, provides connections among educational activities, and helps science teachers make decisions about interactions with students." Al-Rsa'i [14] also stated that constructivist learning strategies such as the implementation of the 7E learning model in teaching science provide different ICT tools and patterns that can be utilized "where the student can perform several tasks and activities and be responsible for his learning process." With these, teachers who are employing a learning model are given the flexibility to integrate different strategies, activities, and instructional materials in achieving the different stages or phases of the model. Several investigations [10]-[15]-[16]-[17] have already invested in integrating Information and Communications Technology in the implementation of a learning model to realize a constructivist learning environment.

Istuningsih et al. [10] developed an interactive electronic module based on the 7E learning cycle, which was utilized through the scientific approach to determine its effect on senior high school students' learning outcomes. Data showed that the fusion of e-module and 7E learning model could improve the learning outcomes of students. Also, the researchers concluded that "e-module learning media collaborated with the learning cycle 7E model can facilitate teachers in order to apply the scientific approach in the learning process in accordance with the current curriculum demands". Correspondingly, Daşdemir [15] enriched the 5E learning model with cooperative learning and animations. Senan [18], on the other hand, designed a multimedia learning package for secondary school physics based on the 5E learning model. He suggested that fusing the model with technology is an excellent tool for the teachers as well as students to bring in the 21st-century skills. Other ICT tools and strategies that are typically integrated to enhance a learning model are either one or a combination of multimedia and computer simulations.

The myriad benefits of computer simulations in the primary science education curriculum have been studied thoroughly in the areas of biology, chemistry, and physics. Generally, the impact of integrating computer simulations in science learning can be categorized into three domains of learning; cognitive, psychomotor, and affective. In the systematic review of D'Angelo et al. [19] on the effect of computer simulations on students' learning in STEM, they classified the influences into achievement outcomes, scientific inquiry and reasoning skills, and non-cognitive outcomes. In addition, most studies in science education "suggest that simulations can be as effective, and in many ways more effective, than traditional (i.e., lecture-based, textbook-based, and physical hands-on) instructional practices in promoting science content knowledge, developing process skills, and facilitating conceptual change" [20].

The incorporation of computer-based simulations to any learning model has the potential to affect science learning and teaching. Senan [18] infused computer simulations in developing his multimedia package for secondary physics designed according to the 5E learning model and suggested that the package has the potential to develop the "21st-century skills in science education curriculum programs and instructional practices". Furthermore, Warliani, Muslim, and Setiawan [17] implemented a 7E learning cycle model with the integration of simulations in selected phases to determine if it improves students' conceptual understanding of mechanical wave material. Findings indicated that a group of students exposed to simulations have better conceptual understanding while at the same time expressed positive feedback towards the application of the 7E learning cycle. These findings have been confirmed by Sarac and Tarhan [16] on their research concerning the preparation and implementation 7E learning model supported with multimedia teaching materials in secondary science courses. Better academic achievement and continual learning were achieved, signifying that the 7E learning model can be enriched with simulations at each of the stage or a particular stage only. Other related studies on the impact of the 5E or 7E learning model and computer simulations to science education have been focused on students' scientific achievements and attitudes [21] [15].

On the contrary, other studies on the efficacy of computer simulations in science teaching have reported unimpressive results. The study of Marshall and Young [22] has shown that computer simulations were less effective than traditional instruction and hands-on laboratory strategies. Winn et al. [23] also noted that field experience is still the best way to provide students authentic contextual experiences while the use of simulation made it easier for students to connect their learning experiences to other learned contents. Sarabando, Cravino, and Soares [24] therefore suggested that in order to attain the full potential of computer simulations as effective educational innovations, teachers should be provided with the necessary skills and knowledge on how to integrate these in their teaching activities. Rutten et al. [25] have earlier stressed that computer simulations can have significant impacts on science education when its interplay with the nature of the content, the student and teacher are considered. Clearly, the pedagogy of teachers to which these computer simulations are used in the classroom may guarantee the efficacy of these simulations. As such, teachers play the central role in "selecting appropriate resources, sequencing and structuring learning activities and guiding students´ experimentation, generation of hypotheses and predictions, and critical reflection upon outcomes" [24].

The main objective of this study is to developed computer-based learning material in physics for STEM-strand students and teachers. Specifically, it aims to determine the quality of the learning material in terms of content quality, instructional quality, technical quality and accuracy (other findings).

MATERIALS AND METHODS

Research Design

The study is a development research study, particularly type 1 that involves analysis, design, development, and evaluation; hence an instructional design model was used. The non-linear ADDIE instructional design model was utilized from the concept analysis up to the evaluation of learning material. This model was used in the study since it is the most appropriate design model in developing technology-based instruction and instructional materials. The model allows the researcher to revisit any of the stages as needed continually, and modifications were implemented continuously along the process.

Participants of the Study

The evaluators of the learning materials in the final stage of this study are senior high school physics teachers from different private and public secondary schools. They are composed of 22 senior high school physics teachers who have taught physics or are currently teaching physics in the STEM strand curriculum.

Instrumentation

The computer-based learning material was evaluated using the tool of the Department of Education in evaluating non-print materials which is present in the Learning Resource Management and Development System (LRMDS) framework. The instrument contains 37 items that are categorized into content quality, instructional quality, technical quality, and other factors that include accuracy and up-to-datedness of information. All items were rated from a range of 1-4, with one (1) being not satisfactory, 2-poor, 3-satisfactory/not applicable, and 4-very satisfactory. For content and instructional quality, the passing score is 30 points out of a maximum of 40 points. In technical quality, however, a score of 39 out of a maximum of 52 points is required for the learning material to pass. For other findings, a perfect score of 16 points is required for the material to be accepted in this criterion.

Phases of the study

The different stages in the ADDIE model were used in this study. One goal of applying the ADDIE model is to ensure that all critical components of instruction, such as inclusion of learning objectives, appropriate teaching strategies, and relevant assessment methods, are present in any resulting course or curriculum [26].

Analysis and Treatment of Data

In determining the quality or the extent to which the learning material meets the criteria, mean and percentage were used. The following is the scale used in the interpretation of mean scores:

Mean Range	Descriptive Equivalence
1.00- 1.74	Not Satisfactory
1.75-2.49	Poor
2.50-3.24	Satisfactory/Not Applicable
3.25- 4.00	Very Satisfactory

RESULTS AND DISCUSSION

Clarke [27] emphasized that the process of designing computer-based learning (CBL) materials is a complex task that involves a mixture of factors and variables. Engaging and adaptable materials used in computer-based learning could be a powerful tool in delivering motivating learning and teaching experiences for both students and teachers. These CBL materials should feature desirable attributes to make it appealing to potential users. These may include but not limited to interactivity, reproducibility, accessibility, dynamic display, the combination of multiple media, learners' control, and capacity to provide independent and collaborative learning. Therefore, the learning material designed, developed, and evaluated in this study was structured in accordance with existing guidelines and principles. Also, a development research study should be structured in phases where an instructional design model is usually implemented.

Sculpted by these principles and qualities, the final version of the computer-based learning material through the 7E learning model and integrated with simulations is packaged in the form of a CD-ROM. It is an offline version of a website that can be easily saved and installed on desktop computers and laptops. The learning competencies were derived from the K-12 Physics 2 teaching guide for the STEM strand focusing on DC circuits. There are two components of the learning material, one for teachers and another for students. The teachers' resource corner contains the lesson exemplar, complete activities in pdf format, notes and tips, plugins, and simulations to be used by the students. On the other side, the students' resource corner contains the different activities that the students need to accomplish in each stage of the 7E learning model. The activities are designed to cater to independent and collaborative learning. In addition, teachers who want to utilize the learning material have the options to modify the activities based on their resources and the needs of their students.

Quality of Computer-Based Learning Material

The completed CBL material was subjected to evaluation by senior high school physics teachers using the tool of the Department of Education for evaluating non-print instructional materials. Based on the tool, the material was evaluated by validators in terms of content, instructional, technical, and other findings with a total of thirty-seven (37) items. Table 1 shows the overall result of evaluation by physics teachers.

Table 1. Overall Quality of the Learning Material

Criteria	Mean	Remark
Content Quality	3.92	VS
Instructional	3.90	VS
Technical	3.60	VS
Accuracy (Other findings)	4.00	VS
Overall Mean	3.85	VS

The overall quality of the learning material is very satisfactory, as shown by the overall mean of 3.85. All of the four (4) criteria are evaluated as "very satisfactory" with accuracy (other findings) quality having the highest mean of 4.00. In contrast, technical quality has the lowest mean of 3.60. Based on the overall mean, the learning material is generally considered a good instructional material as determined by the evaluation tool used.

Content quality. One of the most important elements in evaluating digital or non-digital learning materials is its content. The content of a learning material must be accurate, up-to-date, meet the curriculum standards and learning objectives and free from any form of prejudice towards learners. Dahlan and Wibisono [28] highlighted the importance of evaluating the content of interactive learning materials if it certainly establishes the concepts and principles of the subject matter. Table 2 presents the different indicators for content quality.

Table 2. Content Quality Indicators

Criteria	Mean	Remark
1. Content is consistent with topics/skills found in the DepEd Learning Competencies for the subject and grade/year level it was intended.	4.00	VS
2. Concepts developed contribute to enrichment, reinforcement, or mastery of the identified learning objectives.	3.95	VS
3. Content is accurate.	4.00	VS
4. Content is up-to-date.	3.95	VS
5. Content is logically developed and organized.	3.85	VS
6. Content is free from cultural, gender, racial, or ethnic bias.	4.00	VS
7. Content stimulates and promotes critical thinking.	3.95	VS
8. Content is relevant to real-life situations.	3.65	VS
9. Language (including vocabulary) is appropriate to the target user level.	3.90	VS
10. Content promotes positive values that support formative growth.	3.95	VS
Criterion Mean	3.92	VS

Based on the evaluation tool used in this study, the content quality is composed of ten (10) indicators that deal primarily with the accuracy, organization, development, relevance, adaptability, language, free from gender and cultural bias, and the capacity to promote positive values and critical thinking. As reflected in the data, the mean of 3.92 signifies a "Very Satisfactory" description on this aspect. The learning material is thus consistent with the learning objectives in General Physics 2 of the senior high school-STEM strand, as indicated by the mean of 4.0 given by validators. Likewise, the contents are accurate and free from gender, cultural, or ethnic bias, as shown by the highest means for these items. However, though all items are gauged as very satisfactory, the item with the lowest mean is on relevance to real-life situations. This can be associated with the nature of the subject matter and validators' diverse preferences [29]. Some validators stated that they prefer real-life examples and applications in some of the phases of the learning model that will enable students to make further associations with their real-life experiences. It can also be argued that simulations restrict the opportunity for students to perform a real physical examination or demonstrate motor skills. At the same time, simulations cannot assess students' practical skills [30].

Instructional quality. Ciavarelli [31] discussed the importance of assessing instructional quality in all components of an instructional system, including the "quality and value of the instructional content, the instructor's performance, the instructional strategy used, the presentation method the delivery system, the appropriateness and reliability of the technology and media, and the institutional support services." Table 3 shows the different indicators for instructional quality.

Table 3. Instructional Quality Indicators

Criteria	Mean	Remark
1. Purpose of the material is well defined.	4.00	VS
2. Material achieves its defined purpose.	3.95	VS
3. Learning objectives are clearly stated and measurable.	3.95	VS
4. Level of difficulty is appropriate for the intended target user.	3.90	VS
5. Graphics / colors / sounds are used for appropriate instructional reasons.	3.90	VS
6. Material is enjoyable, stimulating, challenging, and engaging.	3.85	VS
7. Material effectively stimulates creativity of target user.	3.95	VS
8. Feedback on target user's responses is effectively employed.	3.70	VS
9. Target user can control the rate and sequence of presentation and review.	3.85	VS
10. Instruction is integrated with target user's experience.	3.95	VS
Criterion Mean	3.90	VS

Indicators on the instructional quality element of the packaged learning material contain the general purpose of the material, appropriateness, and the instructional structure of the material in achieving the desired learning outcomes. Results show that the instructional quality of the computer-based learning material is very satisfactory, as indicated by the mean of 3.90. Also, all items were evaluated as very satisfactory with the item on definite purpose as the highest and feedback mechanism the lowest. The low mean of feedback mechanism as compared to the other items can be linked to the nature of the learning material where learners are only given feedbacks after completing the different phases of the learning model. However, the simulations used in the study provide users immediate feedback on the process of using these simulations. On the other hand, items on the appropriateness of design, suitability to target users, and instructional organization are all rated close to the highest possible mean. Some validators also argue that some of the problems might be difficult for some students, given the limited time to perform all the tasks.

Technical quality. Anderson, Taraban, and Sharma [33] highlighted the importance of focusing attention on the technical difficulties that may discourage students from using a CD-ROM learning material. Technical problems may cause frustrations on the part of the students, and teachers may tend to make the material less relevant in achieving the goals of the learning course. Table 4 presents the technical quality indicators.

Table 4. Technical Quality Indicators

Criteria	Mean	Remark
1. Audio enhances understanding of the concept.	3.25	VS
2. Speech and narration (correct pacing, intonation, and pronunciation) is clear and can be easily understood.	3.15	S
3. There is complete synchronization of audio with the visuals, if any.	3.10	S
4. Music and sound effects are appropriate and effective for instructional purposes.	3.15	S
5. Screen displays (text) are uncluttered, easy to read, and aesthetically pleasing.	3.80	VS
6. Visual presentations (non-text) are clear and easy to interpret.	3.85	VS
7. Visuals sustain interest and do not distract user's attention.	3.90	VS
8. Visuals provide accurate representation of the concept discussed.	3.95	VS
9. The user support materials (if any) are effective.	3.85	VS
10. The design allows the target user to navigate freely through the material.	3.80	VS

11. The material can easily and independently be used.	3.95	VS
12. The material will run using minimum system requirements.	3.65	VS
13. The program is free from technical problems.	3.45	VS
Criterion Mean	3.60	VS

Based on the indicators for technical quality, this aspect comprises the design, appropriateness, and reliability of the media (graphics, audio) and the instructional strategy on how the different media are utilized and integrated. Other items that are considered in this aspect are ease of use, system requirement, and support. Results reveal that the mean of technical quality is the lowest mean among the four aspects with a value of 3.60 but is still classified as "very satisfactory." All indicators except items concerning audio are scored within the very satisfactory range implying that the material passes this criterion. Consequently, all items concerning auditory support (audio, speech, music, sound effects) are rated satisfactory or not applicable, as there were no audio materials used. As such, some validators suggested that narration could be added as an enhancement in the different phases of the learning model to cater to the needs of auditory learners. Other validators also pointed out that they have encountered some minor technical glitches due partly to system requirements but were resolved immediately with the system support present in the teachers' resource corner.

Other findings

The last criterion is stated as other findings in the evaluation tool. However, it is primarily associated with the material's quality of being free of conceptual, factual, typographical or grammatical, and other errors. Table 5 shows the ratings of evaluators on the different indicators for other findings.

Table 5. Other Findings Indicators

Criteria	Mean	Remark
1. Free of conceptual errors.	4.00	VS
2. Free of factual errors.	4.00	VS
3. Free of grammatical and / or typographical errors.	4.00	VS
4. Free of other errors (i.e., computational errors, obsolete information, errors in the visuals, etc.).	4.00	VS
Criterion Mean	4.00	VS
Overall Mean	3.85	VS

Based on the results, this criterion is classified as very satisfactory, as represented by the mean of 4.00. All of the indicators are rated impeccably by the evaluators. The result is in acquiescence to the guidelines set by the Department of Education which clearly states that there should be no items in this criterion rated below the perfect score. In addition, a material that fails in one of the four quality elements should not be endorsed for possible use and should only be recommended for approval provided that corrections or revisions are made. As such, the learning material can be recommended for approval and endorsed for possible use in public schools.

Conclusion

In sum, the computer-based learning material designed according to the 7E learning model and integrated with computer simulations developed in this study has been evaluated by physics teachers who are the potential users to be a good set of instructional material in physics in the STEM curriculum. The material follows a non-conventional format of integrating computer simulations through the 7E learning model that utilizes the constructivist (inquiry-based) approach in achieving the desired learning competencies, as reflected by the target users' evaluation. Based on the evaluation, there exists the potential of the learning material to cause significant impacts on teaching and learning physics.

Based on the results, the following recommendations are meant to enhance the present study:

- The CBL material may be utilized and evaluated by a higher number of teachers and students in public and private senior high schools to assess its acceptability and impact on physics learning.
- The CBL material may be subjected to an experimental study to determine its potential effect on students' academic performance and attitude towards physics.
- An appropriate assessment tool may be made in order to assess the material in terms of its pedagogical attributes as a method of implementing the 7E learning model and its suitability in creating a constructivist learning environment.
- Detailed analysis of the activities and simulations used in each phase of the learning model may be conducted by a group of experts (instructional material developers) and end-users (teachers) to further assess the learning material.

References

[1] Ornek, F., Robinson, W. R., & Haugan, M. P. (2008). What makes physics difficult? International Journal of Environmental and Science Education, 3(1), 30-34.

[2] Ocampo, C. A., de Mesa, D. M. B., Ole, A. F., Auditor, E., Morales, M. P. E., Sia, S. R. D., & Palomar, B. C. (2015). Development and evaluation of physics microlab (P6-Î¼Lab) kit. The Normal Lights, 9(1).

[3] Oon, P. T., & Subramaniam, R. (2011). On the declining interest in physics among students—from the perspective of teachers. International Journal of Science Education, 33(5), 727-746.

[4] Abdulrachman, N. M. (2018). A Benchmarking of the status of science instruction between two selected secondary schools in Philippines and Malaysia: A case study. International Journal of Humanities and Social Sciences, 10(3), 31-44.

[5] Orleans, A. V. (2007). The condition of secondary school physics education in the Philippines: Recent developments and remaining challenges for substantive improvements. The Australian Educational Researcher, 34(1), 33-54.

[6] SEI-DOST & UP NISMED, (2011). Science framework for Philippine basic education. Manila: SEI-DOST & UP NISMED.

[7] Learning Model. (n.d.). In Alleydog.com's online glossary. Retrieved from: https://www.alleydog.com/glossary/definition-cit.php?term=Learning+Model

[8] Eisenkraft, A. (2003). A proposed 7E model emphasizes 'transfer of learning 'and the importance of eliciting prior understanding. Sci. Teach, 70, 6.

[9] Duran, L. B., & Duran, E. (2004). The 5E instructional model: A learning cycle approach for inquiry-based science teaching. Science Education Review, 3(2), 49-58.

[10] Istuningsih, W., Baedhowi, B., & Sangka, K. B. (2018). The effectiveness of scientific approach using e-module based on learning cycle 7E to improve students' learning outcome. International Journal of Educational Research Review, 3(3), 75-85.

[11] Suardana, I. N., Redhana, I. W., Sudiatmika, A. A., & Selamat, I. N. (2018). Students' critical thinking skills in chemistry learning using local culture-based 7E learning cycle model. International Journal of Instruction, 11(2), 399-412.

[12] Siribunnam, R., & Tayraukham, S. (2009). Effects of 7-E, KWL and conventional instruction on analytical thinking, learning achievement and attitudes toward chemistry learning. Journal of social sciences, 5(4), 279-282.

[13] Balta, N., & Sarac, H. (2016). The effect of 7E learning cycle on learning in science teaching: a meta-analysis study. European Journal of Educational Research, 5(2), 61-72.

[14] Al-Rsa'i, M. S. (2013). Promoting scientific literacy by using ICT in science teaching. International Education Studies, 6(9), 175-186.

[15] Daşdemir, İ. (2017). The effect of the 5e instructional model enriched with cooperative learning and animations on seventh-grade students' academic achievement and scientific attitudes. International Electronic Journal of Elementary Education, 9(1), 21.

[16] Sarac, H., & Tarhan, D. (2017). Effect of multimedia assisted 7e learning model applications on academic achievement and retention in students. European Journal of Educational Research, 6(3), 299-311.

[17] Warliani, R., Muslim, & Setiawan, W. (2017, May). Implementation of 7e learning cycle model using technology-based constructivist teaching (TBCT) approach to improve students' understanding achievement in mechanical wave material. In AIP Conference Proceedings (Vol. 1848, No. 1, p. 050005). AIP Publishing.

[18] Senan, D. C. (2013). Infusing BSCS 5E instructional model with multimedia: A promising approach to develop 21st century skills. Journal on School Educational Technology, 9(2), 1-7.

[19] D'Angelo, C., Rutstein, D., Harris, C., Bernard, R., Borokhovski, E., & Haertel, G. (2014). Simulations for STEM learning: Systematic review and meta-analysis. Menlo Park: SRI International.

[20] Smetana, L. K., & Bell, R. L. (2012). Computer simulations to support science instruction and learning: A critical review of the literature. International Journal of Science Education, 34(9), 1337-1370.

[21] Kocakaya, S., & Gonen, S. (2010). The effects of computer-assisted instruction designed according to 7E model of constructivist learning on physics student teachers' achievement, concept learning, self-efficacy perceptions and attitudes. Turkish Online Journal of Distance Education, 11(3), 206-224.

[22] Marshall, J. A., & Young, E. S. (2006). Preservice teachers' theory development in physical and simulated environments. Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 43(9), 907-937.

[23] Winn, W., Stahr, F., Sarason, C., Fruland, R., Oppenheimer, P., & Lee, Y. L. (2006). Learning oceanography from a computer simulation compared with direct experience at sea. Journal of Research in Science Teaching, 43(1), 25-42.

[24] Sarabando, C., Cravino, J. P., & Soares, A. A. (2014). Contribution of a computer simulation to students' learning of the physics concepts of weight and mass. Procedia Technology, 13, 112-121.

[25] Rutten, N., Van Joolingen, W. R., & Van Der Veen, J. T. (2012). The learning effects of computer simulations in science education. Computers & Education, 58(1), 136-153.

[26] Ciavarelli, A. (2003). Assessing the Quality of Online Instruction: Integrating Instructional Quality and Web Usability Assessments. U.S. Department of Education. Office of Education Research and Improvement. Educational Resources Information Center. (ERIC).p.698

[27] Clarke, A. (2018). Designing computer-based learning materials. Routledge.

[28] Dahlan, J. A., & Wibisono, Y. (2017). Design and development computer-based e-learning teaching material for improving mathematical understanding ability and spatial sense of junior high school students. In Journal of Physics: Conference Series (Vol. 812, No. 1, p. 012098). IOP Publishing.

[29] McKenney, S., & van den Akker, J. (2002). Computer-based support for science education materials developers. In 10h Annual Meeting of the Southern African Association for Research in thematics, Science and Technology Education 2002 (pp. 406-417). University of Natal, RSA.

[30] Jack, G. U. (2017). The effect of learning cycle constructivist-based approach on students' academic achievement and attitude towards chemistry in secondary schools in north-eastern part of Nigeria. Educational Research and Reviews, 12(7), 456-466.
[31] Ciavarelli, A. (2003). Assessing the Quality of Online Instruction: Integrating Instructional Quality and Web Usability Assessments.
[32] Gusmida, R., & Islami, N. (2017). The development of learning media for the kinetic theory of gases using the ADDIE model with augmented reality. Journal of Educational Sciences, 1(1), 1-10.
[33] Anderson, E. E., Taraban, R., & Sharma, M. P. (2005). Implementing and assessing computer-based active learning materials in introductory thermodynamics. International Journal of Engineering Education, 21(6), 1168.