Developing an Android-Based Test on Colligative Properties of Solution

S Sari\(^1\), R Nuralam\(^1\), and C Z Subarkah\(^1\)

\(^1\)Department of Chemical Education, UIN Sunan Gunung Djati Bandung, Jl. A.H. Nasution No. 105, Bandung 40614, Indonesia

\(^*\)sari@uinsgd.ac.id

Abstract. Android-based tests in chemistry are still limited and few in development. This research has been carried out to describe the result of developing an Android-based test on the colligative properties of the solution. The method used in this research was descriptive qualitative. The product/application was created using the Android Studio application (in the .apk format) and can be used on smartphones. Moreover, its details are described, including every visual appearance. The application is interesting, easy to use, can be accessed offline and visualizes animated videos so that it can be used to measure student's ability to explain the colligative properties.

1. Introduction

Assessment cannot be separated from the learning process because it examines the validity and the reliability of information [1–3]. Assessment can be carried out in the form of a test or non-test. Assessment by the teacher is carried out through several steps such as planning, designing assessment instruments, collecting information via evidence which indicates students' competence achievement, processing and making use of information regarding students' achievement of competence [4].

In this 21st century, the revolution of knowledge and technology, society changes, the comprehension regarding children's ways of learning, the advancement of communication and information media, etc. have contributed new meanings to learning activities [5]. This condition emphasizes the importance of technology approach in education and learning management. In a real implementation, teachers are imposed to possess methodical skills in designing and conducting learning and the mastery of learning media usage [6–9].

The usage of learning media in the learning process can improve students' interest and motivation, stimulate their curiosity and their will to learn and even provide positive influences on their psychology. Moreover, learning media can also improve comprehension, present data, and compact information, allowing students to learn more easily [10].

One of the learning media that employs information technology is mobile learning. Mobile learning can increase students' interest in learning materials. Mobile learning is used as a learning aid and provides an opportunity for students to learn the materials they have not yet mastered anyplace and anytime [11].

Mobile learning is selected due to the high usage of smartphones in Indonesia. Based on the data provided by the digital research institution E-marketer, approximately in 2018, the active users of smartphones reached more than 100 million people [12]. The usage of smartphones includes internet browsing, email, blogging, and games.

Chemistry is rooted in abstract concepts, making it rather difficult to comprehend, especially when students are in a position where they have to believe something without seeing it [13]. One chemical
concept which is deemed difficult is the colligative properties of a solution. This is so because it involves lots of concepts and calculations [14]. Based on conceptual analysis, the colligative properties of the solution are an abstract concept with concrete instances.

Based on the above explanation, to accommodate chemical tests in chemistry subjects, digital form is used by presenting animated videos regarding the concept of colligative properties of the solution. This attempt is intended to reduce paper usage in learning and to help the teacher assess students' comprehension more easily. Therefore, research regarding "developing Android-based test on colligative properties of the solution" was carried out.

2. Research Method
The method used in this research is descriptive-qualitative, where data are presented in the form of words and images, not numbers. The data were collected via interviews, field notes, photos, videos, personal documentation, notes or memos and another form of documentation [15].

3. Result and Discussion
The research resulted in an Android-based test for colligative properties of solution in .apk format which can be used in smartphones. Each display of the application is described as follows.

3.1 Menu Display
The menu display of the test application is displayed in figure 1.

![Figure 1. Menu Display](image-url)

As displayed in figure 1, the menu display consists of several buttons regarding the usage of the application. The BC and Indicators (Ind: KD dan Indikator) button displays Basic Competencies of concepts of colligative properties of solution and question indicators for each test. The start (Ind: mulai) button directs the user to fill in name and class columns before doing tests. The developer's profile (Ind: Profil penyusun) button displays the identities of the researchers and advisors I and II. The exit button allows the user to quit the application [16].

3.2 User Guide Display
The user guide (Ind: petunjuk penggunaan) display is displayed in figure 2.
Figure 2. User Guide Display

As displayed in Figure 2, the user guide display consists of a procedure of using the application from the starting to the finishing points of the Android-based test on the colligative properties of the solution. It helps users to understand the steps to take to generate results and avoid errors or mistakes in operating the application [16].

3.3 BC and Indicators Display

The BC and indicators (Ind: KD dan Indikator) display is displayed in figure 3.

Figure 3. BC and Indicators Display

As displayed in figure 3, the BC and indicators display contains Basic Competencies of the concepts of colligative properties of solution that is BC 3.1 “to analyze phenomena of colligative properties of solution (decrease in saturated steam pressure, increase in the boiling point, decrease in the freezing point and osmosis pressure)” and indicators of each question presented in the application.
3.4 Start Display
The start display is displayed in figure 4.

![Start Display](image)

Figure 4. Start Display

As displayed in figure 4, the start (Ind: mulai) display consists of the name column and class column which must be filled in before doing tests. After filling in the required columns, the user can proceed further by pressing the start (Ind: kerjakan) button to enter the next display which consists of questions on the colligative properties of the solution. Without filling in the required identity columns, the user cannot proceed to the next display.

3.5 Questions and Multiple-choices Display
The questions display is displayed in figure 5.

![Questions and Multiple-choices Display](image)

Figure 5. Questions and Multiple-choices Display

The test application consists of questions regarding the colligative properties of a solution. The questions are in the form of two-tier multiple choice. There are ten questions and each question has two phases or tiers. The first tier consists of questions regarding the colligative properties of the solution and the second tier consists of the rationale behind how an answer in tier I is selected. Questions in both tiers I and II are in the form of multiple choices. When a student chooses an answer in each tier's question, the activity is displayed in figure 6.
As displayed in figure 6, when a student chooses an answer he thinks it is right in each tier's question, the color of the chosen answer transforms from green to yellow. This applies to all questions in the application.

3.6 Test Completion Confirmation Display
Once all questions are answered, then it is time to end the test. To end it, press the next button in the 10th question display. A confirmation box will appear regarding the test completion. It is displayed in figure 7.

As displayed in figure 7, the confirmation display consists of two buttons (Yes and No). The no (Ind: tidak) button cancels the confirmation while the yes (Ind: ya) button confirms that the test is completed.

3.7 Completed Display
The completed display is displayed in figure 8.
As displayed in figure 8, the completed display consists of information regarding the name and the class which was filled in during the start display. The score gained by the student after completing the test is also displayed on this display. The discussion (Ind: pembahasan) button directs users to a display that describes each question and its answer in the test application. The return to menu (Ind: kembali ke menu) button directs the user to return to the menu display.

4. Conclusion

From the research results, it can be concluded that the Android-based test on the colligative properties of the solution was designed to feature interactive, interesting displays, ease usage, and animated videos so that it can be used to measure student's ability to explain and apply the concepts of colligative properties of the solution.

References

[1] A. C. John 2015 Reliability and Validity: A Sine Qua Non for Fair Assessment of Undergraduate Technical and Vocational Education Projects in Nigerian Universities J. Educ. Pract. 6 34 68–75
[2] H. K. Mohajan 2017 Two Criteria for Good Measurements in Research: Validity and Reliability Ann. Spiru Haret Univ. Econ. Ser. 17 4 59–82
[3] G. Shirali, M. Shekari, and K. A. Angali 2018 Assessing Reliability and Validity of an Instrument for Measuring Resilience Safety Culture in Sociotechnical Systems Saf. Health Work 9 3 296–307
[4] Alimuddin 2014 Pros. Semin. Nas. 11 24–33
[5] Yuberti, S. Latifah, A. Anugrah, A. Saregar, Misbah, and K. Jermsittiparsert 2019 Approaching Problem-Solving Skills of Momentum and Impulse Phenomena Using Context and Problem-Based Learning Eur. J. Educ. Res. 8 4 1217–1227
[6] M. Y 2012 Media Pembelajaran. (Jakarta: Gaung Persada Press)
[7] D. Parsons and J. Adhikari 2016 Bring your own device to secondary school: The perceptions of teachers, students and parents Electron. J. e-Learning. 14 1 66–80
[8] S. Ghavifekr and W. A. W. Rosdy 2015 Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools Int. J. Res. Educ. Sci. 1 2 175
[9] A. Saavedra and V. D. Opfer 2012 Learning 21st-Century Skills Requires 21st-Century Teaching Phi Delta Kappan. 94 2 8–13
[10] Arsyad. A 2014 Media Pembelajaran. (Depok: PT. Rajafindo Persada)
[11] Domingo M. G and Gargante. A 2016 Comput. Hum. Behav. 56 21–28
[12] Wirawan. P. W 2012 J. Masy. Inform. 2 4 21–26
[13] Osman. M. A 2012 Int. J. New Comput. Archit. Their Appl. 2 1 275–286
[14] Stojanovska. M 2014 Orig. Sci. Pap. 35 1 37–46
[15] L. J. Moleong 2005 Metodologi Penelitian Kualitatif. (Bandung: Remaja Rosdakarya)
[16] S. Sari, R. Anjani, I. Farida, and M. A. Ramdhani 2012 Using Android-Based Educational Game for Learning Colloid Materia J. Phys. Conf. 895 1