*International Journal of Research and Review*
*Vol.7; Issue: 10; October 2020*
*Website: www.ijrrjournal.com*
*Research Paper* *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

# The Development of PowerPoint-iSpring Multimedia Integrated Multiple Representation and Prompting Question on Topic of Buffer Solution for Senior High School Learning

**Nova Putri, Guspatni**

Department of Chemistry, Padang State University, Jl. Prof Hamka, Air Tawar Barat, Padang, West Sumatera, Indonesia

Corresponding Author: Guspatni

## ABSTRACT

Understanding the buffer solutions topic requires explanations and visual representations of macroscopic, sub-microscopic, and symbolic (multiple chemical representations) concepts. This Research and Development (R&D) research aims to develop a PowerPoint-iSpring multimedia on the topic of buffer solutions to help students understand the concepts through the integration of multiple chemical representations and prompting questions that accompany the representations. Define, design, and develop the stages of the 4-D development were performed. Validation of the multimedia developed was done to six expert validators and data were analysed with Aiken V formula. Overall analysis results the validity PowerPoint-iSpring multimedia "valid" with a value of 0.9.

***Keywords:*** PowerPoint-iSpring, Multimedia, Buffer Solutions, 4-D Development Models

## INTRODUCTION

Chemistry can be defined as the study of the composition, properties, and transformations of matter [1]. The buffer solution is one of the XI grade SMA chemistry learning materials. The subject of this buffer solution topic discusses the definition and components of buffer solutions, the working principle of buffer solutions, calculating the pH of buffer solutions, and the application of buffer solutions in everyday life. Understanding the topic of buffer solutions requires explanation and visualization of the macroscopic, sub-microscopic, and symbolic representations of chemistry. A comprehensive chemistry study must contain the interconnections between the three levels of chemical representation [2]. Students need to understand the sub-microscopic and symbolic level explanations as a form of application of the macroscopic experiences they do through practicum activities [3]. Students find it difficult to represent concepts at the sub-microscopic and symbolic level because of their abstract nature [4]. The percentage of students' understanding of the sub-microscopic aspect of the buffer solution material is low [5] this is because students are less aware of the interaction between the buffer solution particles and the conjugated acid-base components that are connected through chemical equilibrium [6]. The student's inability to apply all three levels of chemical representation will be an obstacle in the learning process. For example, the buffer concept of a buffer solution can maintain pH when a little strong acid or strong base was added; this is influenced by the balance between a weak acid/weak base and the conjugate base/conjugate acid contained in the buffer solution. Such an event certainly requires an explanation of the state of the buffer solution at the sub-microscopic level [7].

To represent concepts at this sub-microscopic level, we need a modelling that can be expressed from simple to computer technology, which uses words, two-dimensional images, both stationary and moving in the form of visualizing chemical processes taking place in a buffer solution. The use of instructional media with a sub-microscopic approach can improve student learning [8] and effective in improving students' representational skills in chemical equilibrium material [9]. The use of Information and Communication Technology (ICT) based learning media to model the representation of the buffer solution concepts is in line with the demands of the curriculum described in Permendikbud Number 65 of 2013 concerning the need for interactive, inspiring, and motivating learning to participate actively.

Good learning media will certainly contribute to improve the quality of learning. Many types of media can be used, one of which is PowerPoint. PowerPoint is a software specifically designed to be able to display attractive multimedia programs in the form of slides by utilizing hyperlinks, triggers, and custom animations, easy to create and use. The strengths of PowerPoint include: it can present text, images, movies, sound effects, songs, graphics, and animations and is easy to save, efficient [10]. iSpring can combine animation, video, captions, quizzes, surveys, and conversation simulations. iSpring provides various types of questions for the quiz, namely true and false, multiple responses, filling, sorting, multiple choice. The combination of PowerPoint and iSpring will produce interesting learning media [11].

The learning process following the demands of the 2013 curriculum also emphasizes that students can think critically and be active in finding concepts independently. One of the techniques that can encourage students to think critically and actively in learning is prompting questions. Prompting questions that lead students to discover new concepts and involve using cues or hints to help students answer correctly [12]. Learning using prompting techniques can improve students' critical thinking skills [13] and increase the activeness of answering and the quality of student answers [14]. This study aims to produce a PowerPoint-iSpring Multimedia on the topic of buffer solutions for high school student learning.

## LITERATURE REVIEW

Learning media consists of the words media and learning. The word media comes from the Latin medium which literally means 'middle', 'intermediary' or 'introduction' [15].

The benefits of using learning media in the learning process are (1) it can clarify the presentation of messages and information so that it facilitates and improves learning processes and outcomes, (2) can increase student learning motivation, (3) can overcome the limitations of senses, space and time [15].

The function of learning media is (1) the function of attention, which is to attract and direct attention to concentrate on the content of the lesson related to the visual meaning displayed, (2) the affective function, which can increase student enjoyment when learning (or reading) pictorial text. Visual images or symbols can arouse students' emotions and attitudes, (3) cognitive function, which can facilitate the achievement of learning goals, (4) a compensatory function, which can help weak and slow students to accept and understand the content of the lesson [15].

One of the learning media that is commonly used is Microsoft PowerPoint, which is a presentation application program that appears on the screen using an LCD projector [16] which was created and developed by the Microsoft company and is a media-based program [17]. PowerPoint is a specially designed software that is capable of displaying attractive media programs, easy to manufacture and use and relatively inexpensive, because it does not require raw materials other than tools for data storage.

The advantages of PowerPoint include being able to present text, images, films, sound effects, graphics, and animations. PowerPoint is easy to revise, easy to store, and efficient and can be used repeatedly, can be reproduced in a short time at no cost and can be connected to the internet [10].

According to [18] a new approach to learning and teaching chemistry needs to cover three basic domains: (1) macro chemistry, where chemistry is experienced at the real, visible, and sensory level, (2) sub-microchemistry, which explains macro phenomena at the level of atoms and molecules with a kinetic and (3) symbolic perspective, chemistry which includes representational symbols, equations, stoichiometry and mathematics.

Learning by using prompting techniques involves student activities, namely thinking activities and physical activities that try to build their knowledge, as well as teacher activities that try to guide students, one of which is by giving several questions that require a low level of thinking to high level thinking [19]. According to [12] if the aim is to identify or reinforce certain information, low-level questions are more suitable to be asked. However, if the aim is to encourage students to think about the content being studied, then higher-level questions are more effective in achieving that learning goal.

## MATERIALS & METHODS

This type of research belongs to research and development (R&D). Development research is research consisting of a series of processes or steps to develop a new product or improve an existing product so that it can be accounted for, accompanied by testing the effectiveness of the product [20]. This research was conducted to develop PowerPoint-iSpring multimedia and reveal the level of validity. Multimedia PowerPoint-iSpring is designed with a 4-D development model that consists of four stages, namely Define, Design, Develop, and Disseminate [21]. This research is limited to the development stage, namely the validity test. The validity questionnaire as a research instrument was tested on three chemistry lecturers and three chemistry teachers. The data obtained were analysed using the Aiken V formula [22].

## RESULT AND DISCUSSION

Based on the research that has been done, it is obtained PowerPoint-iSpring multimedia on the topic of buffer solutions using the Research and Development type with the 4-D Model, which is limited to the development stage. At the development stage, the research was carried out until the validity test.

### 1. Define Stage.

At the Define stage, five analyses were carried out, namely Front End Analysis, Student Analysis, Task Analysis, Concept Analysis, and Learning Objectives Analysis.

### 1.1. Front End Analysis.

This Front End analysis aims to find and determine the problems in the teaching and learning process. This analysis was carried out by filling out questionnaires and interviews with high school chemistry teachers and high school chemistry students who had studied the topic of buffer solutions. In this study, the basis for making this media was the unavailability of learning media that could help students find their concepts and understand chemistry to the sub-microscopic level. The learning media used in schools are still reading and training materials and do not yet fully contain three levels of chemical representation. Also, the learning media used have not been able to increase student activity and direct students to find concepts independently.

### 1.2. Student Analysis.

This analysis aims to identify students as learning targets. Identification aims to determine student characteristics by giving students a questionnaire about their preferred learning activities and learning media, especially for the topic of buffer solutions. The student character obtained is

that students like learning media that is colour, equipped with pictures and videos, and presents material that is clear and easy to understand. Students also like learning using PowerPoint.

**1.3. Task Analysis.**

This analysis is used to facilitate understanding or mastery of learning tasks that must be achieved by students. A task analysis was carried out by analyzed the Basic Competence (KD) of the topic of buffer solutions based on the 2013 curriculum chemistry syllabus and then formulated into Competency Achievement Indicators (GPA). In this study, the analyzed was KD 3.12 (explaining the working principle, pH calculation, and the role of buffer solutions in the body of living things). The GPA formula for KD is explaining the concept of a buffer solution, explaining the components of a buffer solution, explaining the working principle of a buffer solution, explaining the calculation of the pH of a buffer solution, and explaining the role of a buffer solution in the body of a living being.

**1.4. Concept Analysis.**

Concept analysis was conducted to identify the main concepts of the buffer solution topic. The main concepts were the buffer solution, the acid buffer solution, the base buffer solution. Other related concepts were weak acids, conjugate bases, weak bases, conjugate acids, equilibrium, the acid equilibrium constant, and the base equilibrium constant.

**1.5. Analysis of Learning Objectives.**

The formulation of learning objectives is useful for summarizing concept analysis and task analysis to determine the behaviour of the research object. The learning objectives that have been formulated in the buffer solution material are through guiding questions by exploring information from various types of visuals in the media, simple investigations, and processing information, students are expected to be actively involved during the teaching and learning process in progress and discipline, be careful in observing and be responsible in expressing opinions, answering questions, providing suggestions, and criticisms, and being able to explain the concept of buffer solutions, explain the components of buffer solutions, explain the working principle of buffer solutions, explain the pH calculations of buffer solutions and explain the role of buffer solutions in the body of living things.

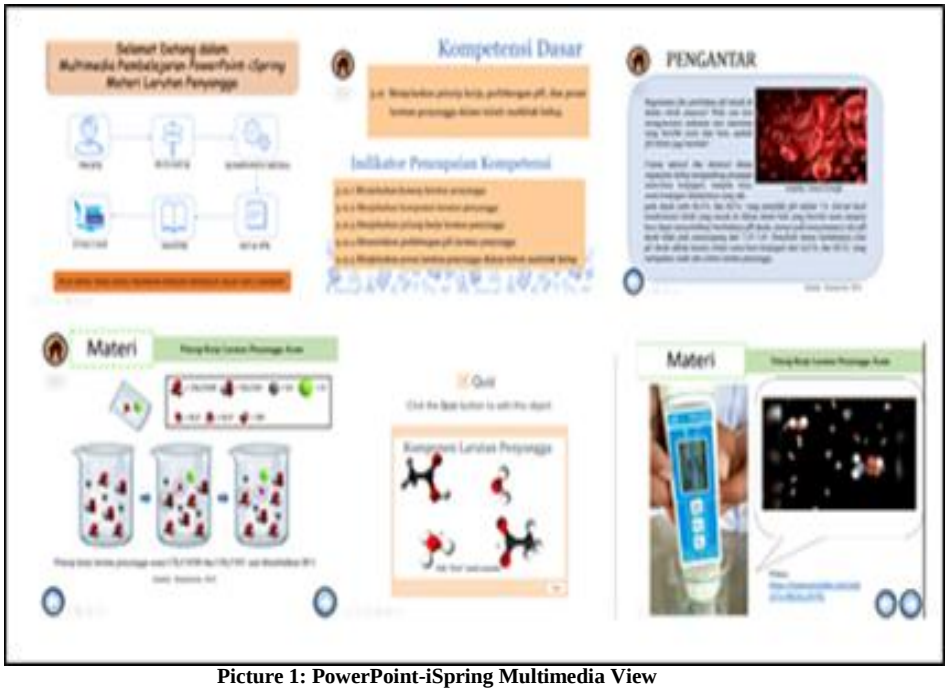
**2. Design Stage.**

This stage aims to design multimedia PowerPoint-iSpring on the topic of buffer solutions for high school learning. The PowerPoint-iSpring Multimedia that has been designed can be seen in Figure 1. The PowerPoint-iSpring Multimedia consists of several slides that are broadly grouped into cover parts; media profile; instructions for use; basic competence/ competency achievement indicators/and Learning Objectives; Theory; and evaluation. The material section contains modelling, animation, or video followed by prompting questions to guide students in finding concepts. The questions are interactive using the Trigger feature where when students click the answer option, feedback will appear whether the answer is correct or wrong. These prompting questions are also made with iSpring with various forms of questions where students will click on one correct answer or more than one correct answer.

Before the main material of the buffer solution, there is a prerequisite material section so that students are ready to learn the concepts in the media. There are several prerequisite materials that students must master before studying buffer solutions, namely Bronsted Lowry's acid-base theory, acid-base equations, and chemical balance. If students do not understand the concept of acid and base balance, students will have difficulty with the concept of buffer solutions [23].

The appearance of the media is made in such a way that the principles of visual

design are still met [24]. What is considered in this media is the amount of information displayed on one slide, colour selection, font size, and illustrations, or modelling by theoretical studies and curriculum demands.




**Picture 1: PowerPoint-iSpring Multimedia View**

## 3. Develop Stage

The validity test aims to reveal the validity of the developed PowerPoint-iSpring multimedia. The validation was carried out by three chemistry lecturers and three chemistry teachers who are experts in their fields. The revision aims to improve media that the validator deems inappropriate. The revision stops when the validator states that the media is valid. The validity of PowerPoint-iSpring multimedia is determined by a validity questionnaire. The PowerPoint-iSpring multimedia assessment is generated from eighteen aspects of the assessment based on four learning media functions [15] namely attention, affective, cognitive, and compensatory functions. The assessment obtained from the validation sheet was then analyzed using the Aiken V formula with an average value of 0.9 with a valid category which can be seen in Figure 2.

Attention function components multimedia PowerPoint-iSpring from the validator shows an Aiken V Formula of 0.9 with a valid category because the Microsoft PowerPoint-iSpring multimedia presentation can provide an attractive and easy-to-understand display, equipped with colour games, letters, animation, text, video, and images. The use of the type and size of the letters used in the media is correct so that it can be read clearly [25].

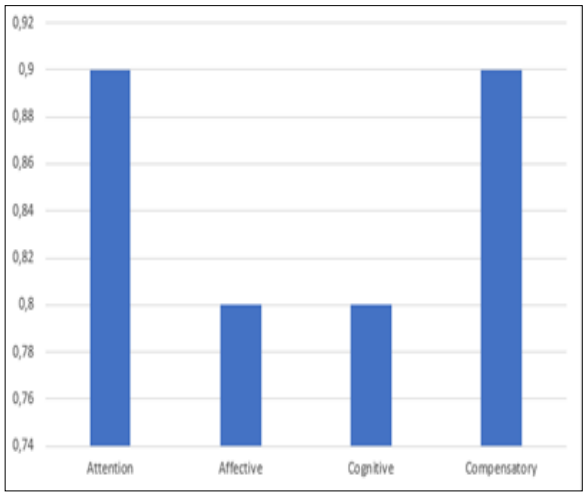



**Figure 2: Value of Aiken V Formula based on media functions**

Affective function components of Multimedia PowerPoint-iSpring from the validator shows an Aiken V Formula of 0.8

with a valid category. Multimedia PowerPoint-iSpring can increase student curiosity, foster enthusiasm for learning, and make learning activities fun because in learning media there are multiple animations of chemical representations, images, videos, and feedback that are displayed when students answer prompting questions asked. The use of various multimedia learning has an effect on the level of student motivation in participating in the teaching and learning process, prevents student boredom in following a learning process, strengthens their understanding of the subject matter [26] and has the potential to generate deeper learning and understanding [27].

The value of the Aiken V Formula on cognitive function is 0.8 with a valid category. These data show that PowerPoint-iSpring multimedia complies with basic competence demands. The topic of buffer solutions in learning media displays facts, concepts, principles, and procedures following basic competence that must be achieved according to the 2013 chemistry syllabus. In this PowerPoint-iSpring multimedia, there is an interconnection between three levels of chemical representation, namely macroscopic, sub-microscopic, and symbolic that is scientifically correct and can help students to understand the topic of the buffer as a whole and comprehensively. Students' understanding of chemistry is demonstrated by the ability to transfer and connect between macroscopic, sub-microscopic, and symbolic representations [2].

The interconnection between the three levels of chemical representation is found in buffer solution material. One example is the working principle of buffer solutions. When the buffer solution is added a little strong acid or strong base or water, the pH of the buffer solution does not change significantly. This conclusion is obtained by students through practicum activities or also called macroscopic representations. The existence of a buffer solution practicum video at the beginning of the media will help students understand the concept without having to do practical activities directly in the laboratory. Buffer solutions can keep pH affected because of the balance between weak acids and conjugate bases which can be explained through sub-microscopic representations that describe how chemical processes occur at the particulate (atom/ molecular) level. Chemical formulas, reaction equations, and calculations of buffer solutions are explained through symbolic representations.

Multimedia PowerPoint-iSpring also contains prompting questions that lead students gradually on each GPA to understand the topic of buffer solutions ranging from simple questions to more complex questions. Learning that is based on thinking processes will lead students to critical thinking skills so that they can solve problems so that it can be said that prompting can train students' abilities to solve problems [28].

Questions that are prompting in learning can require students to be actively involved in learning both mentally and physically so that the learning atmosphere is more enjoyable and learning outcomes can be improved [12]. There are several advantages when prompting questions are applied in the learning process, namely: motivating students to be able to think actively, providing opportunities for students to be able to defend their opinions, providing an experience for students when facing high to low-level questions [29]. Multimedia PowerPoint-iSpring contains feedback on each prompting question asked. This feedback is presented for all student answers, true or false. The concept of feedback provided can determine student creativity, the more feedback provided, the more student creativity needed [30].

The Aiken V Formula of the compensatory function is 0.9 with valid category. PowerPoint-iSpring multimedia is easy to use and learn over and over again. This can help all students understand learning. The combination of images, sound, visual animation of chemical representations

and videos makes PowerPoint-iSpring multimedia an interactive support tool that creates an attractive learning atmosphere and fosters student learning motivation to improve understanding of the concept of buffer solutions [31].

## CONCLUSION

Using the 4D development model, PowerPoint-iSpring multimedia on the topic of buffer solutions for high school student learning has been developed and obtained a valid category judged by the function of the media it carries. An attractive appearance, complete multimedia as a representation of chemical concepts (pictures, animation, and video), guiding questions, and automatic feedback on the media can attract students' attention, provide enjoyment in learning, and help all students understand lesson concepts.

## REFERENCES


1. N. D. Jespersen, J. E. Brady, and A. Hyslop, Chemistry The Molecular Nature of Matter, 6 th ed. New York: John Wiley & Sons Inc, 2012.
2. I. Farida, L. Liliasari, D. H. Widyantoro, and W. Sopandi, "The Importance of Development of Representational Competence in Chemical Problem Solving Using Interactive Multimedia," in Proceeding of The Third International Seminar on Science Education, 2009, pp. 259-277.
3. K. C. D. Tan, N. K. Goh, L. S. Chia, and D. F. Treagust, "Linking the macroscopic, sub-microscopic and symbolic levels: The case of inorganic qualitative analysis," in Multiple representations in chemical education, Springer, 2009, pp. 137-150.
4. R. B. Kozma and J. Russell, "Multimedia and understanding: Expert and novice responses to different representations of chemical phenomena," J. Res. Sci. Teach. Off. J. Natl. Assoc. Res. Sci. Teach., vol. 34, no. 9, pp. 949-968, 1997.
5. Y. I. Ulva, S. Santosa, and P. Parlan, "Identifikasi tingkat pemahaman konsep larutan penyangga aspek makroskopik, submikroskopik, dan simbolik pada siswa kelas XI IPA SMAN 3 Malang tahun ajaran 2013/2014," J-PEK (Jurnal Pembelajaran Kim., vol. 1, no. 2, pp. 69-75, 2016.
6. M. Orgill and A. Sutherland, "Undergraduate chemistry students' perceptions of and misconceptions about buffers and buffer problems," Chem. Educ. Res. Pract., vol. 9, no. 2, pp. 131-143, 2008.
7. D. Alighiri, A. Drastisianti, and E. Susilaningsih, "Pemahaman konsep siswa materi larutan penyangga dalam pembelajaran multiple representasi," J. Inov. Pendidik. Kim., vol. 12, no. 2, 2018.
8. N. Nurlaila, "Peningkatan Hasil Belajar Peserta Didik dengan Menggunakan Media Animasi dengan Pendekatan Submikroskopik Pada Pembelajaran Ikatan Kimia di Kelas X IPA," J. Pengabdi. Magister Pendidik. IPA, vol. 1, no. 1, 2018.
9. D. Utari, N. Fadiawati, and L. Tania, "Kemampuan Representasi Siswa pada Materi Kesetimbangan Kimia Menggunakan Animasi Berbasis Representasi Kimia," J. Pendidik. dan Pembelajaran Kim., vol. 6, no. 3, pp. 414-426, 2017.
10. T. Nurseto, "Membuat media pembelajaran yang menarik," J. Ekon. dan Pendidik., vol. 8, no. 1, 2011.
11. N. Jamilah, "Pengembangan Media Pembelajaran Power Point Ispring Presenter Pada Materi Kosakata Bahasa Arab Peserta Didik Kelas V MI Tarbiyatul Athfal Lampung Timur," al Mahāra J. Pendidik. Bhs. Arab, vol. 5, no. 1, pp. 141-150, 2019.
12. D. A. Jacobsen, P. D. Eggen, and D. P. Kauchak, Methods for Teaching. USA: Pearson Education, 2009.
13. E. Susanti, "Penerapan Model Pembelajaran Probing-Prompting untuk Meningkatkan Kemampuan Berpikir Kritis Matematis Siswa Kelas XI. IPA MAN 1 Kota Bengkulu," J. Pendidik. Mat. Raflesia, vol. 2, no. 1, 2017.
14. G. Guspatni, A. Andromeda, and B. Bayharti, "Peningkatan Aktivitas Menjawab dan Kualitas Jawaban Mahasiswa dengan Pertanyaan Prompting pada Mata Kuliah Strategi Pembelajaran Kimia," J. EKSAKTA Pendidik., vol. 2, no. 1, pp. 101-107, 2018.
15. A. Arsyad, Media Pembelajaran. Jakarta: Raja Grafindo Persada, 2010.
16. H. A. Sanaky, Media Pembelajaran. Yogyakarta: Safria Insania Press, 2009.
17. Daryanto, Media Pembelajaran. Bandung: Satu Nusa, 2010.

18. S. E. Jansoon, Nina., Coll, Richard K, "Understanding Mental Models of Dilution in Thai Students," Int. J. Enviromental Sci. Educ. Vol. 4, No. 2, April 2009, 160., vol. 4, no. 2, p. 160, 2009.
19. Y. Mayasari, "Penerapan Teknik Probing-Prompting dalam Pembelajaran Matematika Siswa Kelas VIII MTsN Lubuk Buaya," J. Pendidik. Mat. Vol. 2. 56-61, 2014.
20. Sugiyono, Metode Penelitian Pendidikan (Penelitian Kualitatif, Kuantitatif dan R&D. Bandung: Alfabeta, 2012.
21. Trianto, Model Pembelajaran Inovatif-Progresif. Jakarta: Kencana, 2009.
22. S. Azwar, Reliabilitas dan Validitas. Yogyakarta: Pustaka Belajar, 2012.
23. M. Masriani and R. P. Sartika, "Pemahaman Konsep Materi Larutan Penyangga Menggunakan Two-Tier Multiple Choice Diagnostic Instrument Di SMA." Tanjungpura University, 2015.
24. S. E. Smaldino, D. L. Lowther, and J. Russel, Instructional Technologies and Media for Learning, 9 th ed. Pearson Merrill/Prentice Hall, New Jersey: Pearson Education, 2012.
25. E. R. Wati, Ragam Media Pembelajaran. Yogyakarta: Kata Pena, 2016.
26. N. Sudjana and A. Rivai, Media Pengajaran. Bandung: Sinar Baru Algesindo, 2011.
27. R. E. Mayer, Multimedia Learning, 2 th ed. Cambridge: Cambridge University, 2009.
28. H. Mustika and L. Buana, "Penerapan Model Pembelajaran Probing Prompting Terhadap Kemampuan Pemecahan Masalah Matematika Siswa," MES J. Math. Educ. Sci., vol. 2, no. 2, 2017.
29. Nasution, Berbagai Pendekatan dalam Proses Belajar dan Mengajar. Jakarta: Bumi Aksara, 2015.
30. Munir, Multimedia: Konsep dan Aplikasi Pendidikan. Bandung: Alfabeta, 2012.
31. W. A. Surasmi, "Pemanfaatan Multimedia untuk Mendukung Kualitas Pembelajaran," Temu Ilm. Nas. Guru VIII, (November), pp. 593-607, 2016.

How to cite this article: Putri N, Guspatni. The development of PowerPoint-iSpring multimedia integrated multiple representation and prompting question on topic of buffer solution for senior high school learning. International Journal of Research and Review. 2020; 7(10): 190-197.

******