



Development of *Tour in Cell* Interactive Media to Improve Cognitive Skills of High School Students

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Abstract

The purpose of this study is to find out the feasibility and effectiveness of *Tour in Cell* interactive media to improve the cognitive skills of high school/MA students. This research uses Research and Development methods consisting of needs analysis, data collection, product design, media validation and design by experts, design revisions, small-scale product trials, product revisions, and wide-scale product trials. Product design in the form of Interactive Media *Tour in Cell* with material validity of 4.33 including category is very feasible 86.67% and media display validity of 4.13 including category is very feasible with a percentage of 82.72%. At the wide-scale trial stage, the improvement in student learning outcomes with the N-gain test resulted in an average N-gain score of 0.59 with moderate criteria. Based on the results of the study can be concluded that the media *Tour in Cell* developed is worth using.

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INTRODUCTION

The material structure and function of cells is a material that is difficult to understand by high school students, this is because the cell material is not visible to the eye. Cell structure should be viewed through observation using a microscope. The many cell structures and their various functions make students less quick to understand the material. Students' cognitive skills to understand the structure and function of cells is very important, as this material is the basis of the next biological material. Therefore, it is necessary to develop learning media that is able to support students' understanding of the material structure and function of cells.

A student's cognitive skills are defined as a person's ability to plan, solve problems, think abstractly, understand complex ideas, learn quickly and learn from experience (Gottfredson, 1997, p.13). Cognitive skills to understand the structure and function of these cells is expected to be absorbed by students in order to better understand the material of biology lessons. The development of interactive learning media is able to improve students' understanding (Salomon, G. 1979). Interactive media contains images, animations, questions exercises in the form of games and there are videos that can support faster absorption of understanding for students. Interactive media is a multimedia display designed by designers to fulfill the function of informing messages and having interactivity to its users (Munir, 2012).

Based on the results of interviews with biology teachers in Madrasah Aliyah (MA) Negeri 2 Grobogan related to cell learning media obtained results that required learning media that is able to make it easier for students to understand the material structure and function of cells, this is seen from the daily replay value of students in sub material structure and cell function that tends to get grades below the criteria of completion (KKM) at least 75 with a percentage of 60% of students and only 40% of students who get completed grades above 75. Students who do not complete KKM complain that the structure and function of cells are too many terms and structures are less obvious making them difficult to understand cells well. This is in line with the results of the needs questionnaire, in which MA Negeri 2 Grobogan students 100% need media that is able to explain the material structure and function of cells more broadly with practice about the form of the game.

Students need media that can facilitate understanding of cells that merge images and description text directly. This is supported by putri research, Andriani et al. the use of multimedia in the application of learning is an effort to create an atmosphere to understand the concept of learning more creatively and innovatively. Other research related to the use of interactive cell media (Khikmah, T. Y., 2013) obtained results of improved student learning outcomes in cell structure and function materials as much as 94% which showed a broader level of student understanding.

The use of interactive learning media in addition to helping improve learning outcomes also increases the active role of students in the classroom. As stated by Wahyuni and Kristianingrum (2008) from the results of his research that the learning media applied in learning can improve the value of learning outcomes and the active role of MA/High School students. One of the reasons is because students feel interested in learning and love the atmosphere of the classroom. Such conditions can motivate students to improve their learning outcomes and active role.

RESEARCH METHOD

This type of research is research and development. *Tour in Cell's* media research and development model uses modified R&D methods from (Sugiyono, 2015). Media *Tour in Cell* contains subsections of cell matter in the form of cell structures and functions that display images, descriptions, videos, and animations about cells. The modified media research and development phase of (Sugiyono, 2015) includes needs analysis, data collection, product design, media validation and design by experts, design revisions, small-scale product trials, product revisions, and wide-scale product trials.

At the level of needs analysis is carried out in MA Negeri 2 Grobogan by observing and interviewing teachers about teaching difficulties and availability of learning media. At this stage, the basic of competency analysis and materials will be discussed in the media *Tour in Cell*. The next stage is the design of an interactive media containing images, descriptions, videos, and animations about the structure and function of cells. The next stage is the validation of design by media experts and validation of materials by material experts in the media *Tour in Cell*. Product revisions are carried out at a later stage to correct weaknesses and deficiencies in terms of appearance and materials. Furthermore, small-scale product trials were conducted with proportionate stratified random sampling techniques. The use of this technique is due to the learning ability of students in schools is heterogeneous and proportionate. The next stage of product revision after small-scale trial results to improve and improve *Tour in Cell* media. After that, a wide-scale product trial was conducted using a sample of 35 students from class XI MIA MA Negeri 2 Grobogan with an experimental design with type One Group Pre-test Post-test Design to know the effectiveness of the *Media Tour in Cell*.

RESULTS AND DISCUSSION

The purpose of this study is to find out the feasibility and effectiveness of media *Tour in Cell* to improve the cognitive thinking abilities of SMA/MA students in sub-material structures and cell functions. Media *Tour in Cell* was developed according to the modified Research and Development method of (Sugiyono, 2015).

Feasibility of *Tour in Cell* Media

The feasibility of interactive media *Tour in Cell* is determined by the assessment of validators namely material experts and media experts. *Tour in Cell's* interactive media assessment sheet refers to the 2013 BSNP regulation on modified SMA Biologi learning media assessment instruments. Interactive media feasibility data is also obtained through teacher and student response questionnaire assessments. *Tour in Cell* interactive media feasibility assessment by validators is conducted before interactive media is tested on a small or wide scale scale. Interactive media feasibility assessments by teachers and students are carried out during small and wide-scale trials.

Tour in Cell media developed by researchers in this study has met the criteria very feasible in terms of media and materials. This is based on the analysis of the feasibility of *Tour in Cell* media being in a very viable category with a percentage of 86.67% of material experts and a percentage of 82.72% of media experts.

Table 1. Material Validation Assessment Results for Interactive Media *Tour in Cell* by Material Experts

No.	Validator	Institutions	Assessment Aspect	Score	Percentage (%)	Criteria
1.	Expert in cell structure and function materials	MA N 2 Grobogan	Linguistics	8	80	Very feasible
			Standard Contents	27	90	Very feasible
			Content feasibility	30	85,71	Very feasible
Average				4,33	86,67	Very feasible

Table 1 shows the material feasibility assessment by the validator. Aspects assessed from the material feasibility assessment include the presentation aspect of the material, the aspect of material language, and the aspect of content feasibility. Table 1 shows an average of 86.67% material worthiness. This suggests that the material in the interactive media developed is included in the criteria is very feasible to be used as a learning medium of biological material structure and cell function Class XI MIA.

The first aspect of material validation is the presentation aspect of the material. Aspects assessed in the presentation of the material include presentation techniques, supporting the presentation of materials,

presentation of learning, and completeness of learning. In table 1, the linguistic aspect gets a percentage value of 80%. This indicates that the presentation of *Tour in Cell* interactive media materials meets assessment indicators in accordance with the learning media according to BSNP regulations. Therefore, the validator gives a high scoring score that is on a scale of four.

The second aspect of material validation is the language aspect. Aspects assessed in language include conformity with development, readability, motivating ability, straightness, coherence and the demands of the thought flow, conformity with Indonesian language rules, and the use of terms or symbols. Table 1 shows data that the percentage value on the linguistic aspect provided by the validator to the developed interactive media is 80%. This suggests that the material criteria of the structure and function of cells in interactive media is very feasible.

The percentage gain indicates that the material in the interactive media developed uses a language that matches the student's mindset. Interactive media developed using Indonesian language in accordance with the enhanced spelling rules (EYD), among them communicative, effective, and easy to understand students when doing learning. This is supported by research by Imtihana et al. (2014), that interesting design components with a communicative, creative look in the presentation of illustrations, tables, and photos make it easier for students to absorb learning materials. In addition, the use of symbols and emblems in interactive media has been consistent. This consistency aims to reduce students' confusion and confusion during learning.

The third aspect is the learning aspect. Aspects assessed include material coverage components, material accuracy, absoluteity and contextuality, legal and statutory obedience and skills. Table 4.1 shows data that the percentage value on the eligibility aspect provided by the validator to the developed interactive media is 86.67% including the very feasible criteria. This indicates that the material criteria of the structure and function of cells in the *Tour in Cell* media is very feasible.

The interactive media content display developed is in accordance with the material structure and function of cells contained in the 2013 curriculum namely KI 3 and KD 3.1 Explaining the chemical components of cell, structure, function, and processes that take place in cells as the smallest unit of life in the sub-material explaining the structure and function of cell parts. The presentation of cell structure and function materials in interactive media starts with the introduction of concepts up to the interaction between concepts. This causes the systematics or sequence of concepts to become systematic. Interactive media content already reflects the stages of activity, presenting observation results using electron microscopes, applying occupational safety aspects, and activities in interactive media displaying cognitive activities.

The presentation of interactive media material begins by presenting a problem that is cutting-edge, concrete and contextual. There is a problem, so in the next learning activity students will look for solutions to the problem. This is in line with the opinion of Djamarah and Zain (2006), that the presentation of problems will stimulate the development of students' thinking skills creatively in finding the right problem solving solution. This is characteristic that *Tour in Cell* interactive media is a medium that is able to make students easier to understand the material structure and function of cells.

Table 2. Material Validation Assessment Results for Interactive Media *Tour in Cell* by Media Experts

No.	Validator	Institutions	Assessment Aspect	Score	Percentage (%)	Criteria
1.	Media Expert	Universitas Negeri Semarang	Linguistics	8	80	Very feasible
			Software Engineering	51	85	Very feasible

	Visual and Audio Appearance	32	80	Very feasible
Average		4,13	82,67	Very feasible

Table 2 shows that *Tour in Cell* interactive media feasibility assessment data obtains an average score of 4.13 which includes highly feasible criteria. This means that the interactive media *Tour in Cell* that has been developed deserves to be used as a learning media supplement for 11th grade of natural sciences high school students at MA Negeri 2 Grobogan.

Based on the results of the interactive media feasibility assessment of *Tour in Cell* by media experts and materials experts obtained interactive media improvement responses. The results of interactive media improvement responses by media experts and materials experts are presented in Table 3.

Table 3. *Tour in Cell* interactive Media Revision results based on Responses from Validators.

No.	Suggestion	Revised
1.	The opening title view should be sorted into interactive media <i>Tour in Cell</i> material structure and cell function and the larger title size.	The opening title is placed sequentially at the top left of the display screen with an interactive media sequence <i>Tour in Cell</i> material structure and cell function
2.	The position of the concept map should be in a vertical position following other views.	A concept map view that was originally horizontal changes to vertical.
3.	The use of the word learner or student should be consistent.	The change in the word learner becomes a student.
4.	The use of sentences should use good and correct Indonesian rules	The use of sentences is corrected, according to the use of the default word in accordance with EYD.

The results of linguistic validation, software engineering, and visual and audio display are presented in table 2. In the table 2 interactive media *Tour in Cell* obtained an average percentage value of 82.72%. This interactive media developed is on the criteria is very feasible if interactive media is used as a learning medium.

The percentage gain indicates that the interactive media developed has the appropriate look to be used as a learning medium. The interactive media developed has an interesting look with many images that can focus students in learning to understand concepts. This is in accordance with the opinion of Bagaray et al. (2016), that interactive media is an interesting medium with a combination of images and sentences that are easy for students to understand, thus increasing students' interest in learning materials.

The illustrations used on the front page of interactive media depict the karekater of the contents of interactive media material. Illustrations on interactive media covers already reveal the character of the object to be studied. In addition, the illustrations used also have shapes, colors, and proportions that correspond to the object to be studied.

All assessment indicators on the visual display aspect and interactive media audio get a perfect score, the typography aspect of interactive media content contains indicators on the typeface used in interactive media, font size, line length of text, spacing between words, and the use of word cutting marks. Validators rated the scores 3 and 4. This indicates that the interactive media developed has a proportional content typography.

All indicators in the illustration aspect of interactive media content get a score of 4. The validator provides the score indicating that the interactive media has been developed according to the indicator. The illustrations in the developed interactive media are arranged in a fit, realistic, proportional manner and are

able to uncover the meaning or meaning of the studied object.

Interactive media developed in addition to obtaining assessments from validators, also obtains responses used as interactive media improvement materials. The response from material validators is that word use is more consistent in developed interactive media. Consistent use of words aims to avoid mis concepts in interactive media users.

The response of media validators to interactive media developed is that interactive media titles are composed more dominantly. *Tour in Cell* interactive media title sequences and cell structure and function materials are arranged sequentially. It aims to prevent students from becoming mis meaning. The competency test format should use an approach. This causes the developed interactive media to be different from interactive media in general. According to the response of the media validator is on the position of the interactive media concept map *Tour in Cell*. This aims to facilitate the reader's point of view.

Tour in Cell Media Effectiveness

The effectiveness of *Tour in Cell* media is determined by the observation sheet of learning activities, pre-test post-test and student response questionnaire sheet. Data on improving student concept understanding was obtained during wide-scale trials. Wide-scale trials were conducted in grade XI MIA MA Negeri 2 Grobogan with a total of 35 students. Data on improving student concept understanding in the form of student pretest grades and student posttest grades were further analyzed using the N-gain test. Data on improving student learning outcomes is presented in table 4.

Table 4. Recapitulation of N-gain Test Results

No.	Test Results	Total
1.	Average pretest score	56,3
2.	Average posttest score	82,2
3.	Maximum score	100
4.	Average of N-gain score	0,59
5.	Criteria	Moderate

Table 4 indicates that the use of *Tour in Cell* interactive media in the study of the biology of material structure and cell function increased N-gain by 0.59. This indicates that the improvement in student learning outcomes is in moderate criteria.

Classical student learning completed data in the form of final grades of students after the implementation of wide-scale trials. Students' final grades consist of assignment grades and post-test grades. The value is then merged into the final value with a valuation weight of 2 for the task value and a valuation weight of 3 for the post-test value. The recapitulation of students' final grades is presented in Table 5 as follows.

Table 5. Recapitulation Results of Large-Scale Trial Students' Final Grades

No.	Test Result	Total
1.	Average of final score	84,5
2.	Highest Final score	92
3.	Lowest Final score	78
4.	Not completed students	0
5.	Completed students	35
6.	Reach minimum score (Completed)	100%

Table 5 shows data that learning with interactive media supplement *Tour in Cell* material structure and cell function has a positive impact with the classical completeness of students by 100% with a set KKM

values of 77. The research indicator was successful, as students' learning completed classically obtained results $\geq 75\%$.

The effectiveness of *Tour in Cell* interactive media in research is characterized by improved understanding of student concepts and classical analysis of student learning. *Tour in Cell* interactive media effectiveness research was conducted during wide-scale trials. In wide-scale trials, interactive media was used as a learning medium for cell structure and function materials in Class XI MIA MAN 2 Grobogan with a total of 35 students.

The learning process in this study follows the steps described in RPP. The learning process begins by providing a pretest. Pretest questions are used to determine students' early abilities on the subjects studied. The average result of a student's pretest score was presented in table 5 which was 56.3. KKM in learning using interactive media *Tour in Cell* is 77. KKM is elevated compared to KKM used in schools by 75. It aims to know the effectiveness of the interactive media developed.

Students who did not complete their pretest grades as many as 28 children and only 7 students completed KKM. Based on the results of pretest scores it can be known that the student's initial knowledge of the material to be studied is still low. In addition, it can be noted that students have not learned and read the material before learning is carried out.

The next stage of learning is learning using *Tour in Cell* interactive media in accordance with RPP. 2 weeks of learning, which is 5 hours of meetings with 3 face-to-face processes. After the learning process is complete, further evaluation is carried out in the form of post-test. Students' posttest grade results are displayed in table 5. The average result of a student's posttest score was 82.1. This indicates that there has been an increase in the number of students whose knowledge abilities are increasing.

Pretest and posttest score data is analyzed using the N-Gain test. The results of the data analysis are shown in table 5. Table 5 shows data that the calculation of N-Gain is obtained by 0.59. The calculation result data is interpreted into the N-Gain table. From the data it is known that there is an increase in the knowledge ability of students in the moderate category.

Tour in Cell interactive media applied as a learning medium in MAN 2 Grobogan is known to improve students' knowledge skills. This is because *Tour in Cell* interactive media implements interactive-based learning. Learning presents an image of the structure and function of cells at the beginning of learning. This is in line with Arends' opinion (2008) that learning by presenting images more clearly will require students to understand the material well. This resulted in improved research processes and high levels of student thinking skills.

Learning using *Tour in Cell* media also improves students' critical thinking skills. This is characterized by many students doing Q&A and arguing scientifically. The questions students ask encourage other students to think about solving problems. Many students argue scientifically against the questions that arise during the learning process. From this learning process, students can apply the knowledge gained in everyday activity.

The results of this study are in accordance with research conducted by Ocsaringga et al. (2016), that the interactive media developed gave a 44.06% influence on the improvement of students' learning outcomes. Students' response to learning using interactive media showed an average score of 88%.

Learning activities using *Tour in Cell* interactive media supplements increase students' activeness in carrying out learning activities independently. This has an impact on the role of teachers who are more dominant in being facilitators. This is in line with Hidayat (2014) that teachers should be able to assist students in solving problems in learning. Teachers therefore help facilitate students in finding problem-solving solutions.

Furthermore, the indicator of the effectiveness of *Tour in Cell* interactive media in learning is the classical learning of students. The table 5 shows data that the final score of the highest learning outcome is 92, while the lowest score is 78 and the average grade is 84.5. From the data, it can be known that the completeness of students learning classically is 100% students reach the minimum score. KKM biology subjects at MA Negeri 2 Grobogan are 75. However, in this study, the KKM limit was changed to 77. This aims to prove that developed media effectively improves students' classical learning.

The final study results of the students with the lowest and highest grades show the diversity of students' learning styles. The learning style of students in this study, various types. This is because each student has their own characteristics and habits in learning. This is in accordance with Rosidah's opinion (2014) that there is not one most effective learning style, but rather each tendency of learning style has its own effectiveness and is unique to an individual.

Student activity is marked at a time when many students are asking scientific opinions and questions. Students' ability to express opinions also increased because students were given the opportunity to present the results of group discussions in front of other groups. This presentation activity aims for a broader discussion forum with other groups. Presentation activities encourage students to exchange opinions with the results of discussions from other groups with teachers as mediators to direct students not to misconceptions. This shows that *Tour in Cell* interactive media developed effectively in learning.

Tour in Cell's interactive media developed effectively improves learning and has met all the expected indicators in this study. The indicators that are to be achieved in this study have been achieved perfectly. These indicators include

1. The measurement of the validity of media for developed interactive media obtained a value of 4.13 with a percentage of 82.27% which is to obtain a score $\geq 75\%$
2. The material validity measurement result for developed interactive media obtained a value of 4.33 with a percentage of 86.67% i.e. obtained a value of $\geq 75\%$
3. Classical student learning results of 100% that are completed students $\geq 75\%$
4. Teacher and student responses scored $\geq 75\%$ of 88% and 77.8%.

In this study, there are still many constraints that affect the results of the study. These constraints include (1) the activeness of students at the beginning of learning is still low, so it is necessary to be stimulated to activate students such as teachers will provide additional grades if students actively ask and argue, (2) during discussion activities, students tend to be competitive with each other showing results to teachers that cause the class to become more rowdy.

Obstacles during research can be overcome in various ways, namely by means of learning process, teachers provide and explain the rules of learning before the implementation of learning. The learning rules contain both negative and positive learning and strengthening rules that students will receive. Therefore, the learning process in the classroom will be more conducive and easier to manage.

Students can understand the material structure and function of cells in *Tour in Cell* media more easily with the presence of representative cell organelle images. Media *Tour in Cell* displays two versions of mitochondrial images in the form of mitochondrial observations using electron microscopy and other images in the form of animated versions of mitochondria. In the mitochondrial image shows the inner indentation of a large number of organelles, this corresponds to the main function of mitochondria as energy producers for the cells of the organism.

CONCLUSION

Based on the results of the study can be concluded that the interactive media of *Tour in Cell* material structure and function of cells that have been developed obtained criteria is very feasible to be used as a learning medium with material validator assessment of 86.67% and media validator assessment of 82.72%. Interactive media of *Tour in Cell* material structure and function of cells that have been developed effectively as a learning medium and improve understanding of student concepts. This was demonstrated by a score of N-gain of 0.59 with moderate category improvement criteria and the results of the student's minimum score analysis increasing by 100%. There is no relationship between learning outcomes and students' attitudes to cell structure and function materials

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