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Yogyakarta, Indonesia, 6-7 May 2015

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MESSAGE FROM THE RECTOR OF YOGYAKARTA STATE UNIVERSITY

Welcome to Yogyakarta, Indonesia!

It is a great honor and pleasure for me to welcome you all to the 3rd International Conference on Educational Research and Innovation held in Yogyakarta, Indonesia. On behalf of Yogyakarta State University and the committee, let me extend my warmest greetings and appreciation to all speakers and participants who have travelled hundreds or even thousands of miles by various transportation means to come to Yogyakarta to attend this conference. It is my strong belief that your safe journey has been due to the blessings granted by God the Almighty and the Most Merciful to Whom we without any further due have to express our gratitude and praise.

It is indeed a privilege for Yogyakarta State University to have the opportunity to organise this very important conference in which educational researchers and practitioners get together to share ideas, experiences, expectations, and research findings. This conference is held as one of the agendas of Yogyakarta State University to celebrate its 51st anniversary. The theme of this year's conference is "Ethics in High-Quality Research".

Research is one of the activities among the academic members of a university. It is a systematic effort to solve the problems or answer the questions by collecting data, formulating the generalities based on the data, then finding and developing organized knowledge by scientific method. It is expected that from research activities valuable empirical facts can be obtained to improve and develop the theory and practice to bring a better quality of education.

Unfortunately, currently issues on ethics are regaining their popularity in various practices of research, such as inaccurate data analyses, data manipulations, and plagiarsm. In response to this, in this year to support the roles of the Institute of Research and Community Services of Yogyakarta State University in encouraging researchers to conduct high-quality researches, an International Conference on Educational Research and Innovation (ICERI) is held under the umbrella theme of Ethics in High-Quality Research. It provides teachers/lecturers, education practitioners, college students, and policy makers the opportunity to share their knowledge, experiences, and research findings which are innovative and relevant to develop the educational practices focusing on the process and product.

This third conference is aimed at discussing the papers on the research findings related to research ethics, and researches on character education, teaching innovations, as well as educational policies. It is expected that this conference will reach its declared objectives succeesfully as a strategic forum to yield recommendations on the importance of ethics in the research to produce high-quality research for the benefits of the human's welfare.

To conclude, let me wish you a fruitful discussion during the conference and an enjoyable stay in Yogyakarta. And finally, hopefully all materials in this conference compiled into a proceeding are useful for us to improve the quality of education and educational research.

Thank you very much for your attention.

Wassalamu'alaikum warrahmatullah wabarakatuh.
May peace and God's blessings be upon you all

Yogyakarta, 6 May 2015
Rector,

Prof. Dr. Rochmat Wahab, M.Pd., M.A.

MESSAGE FROM THE ORGANIZING COMMITTEE

His Excellency Minister of Research and Technology and Higher Education,
Vice Rectors and Deans of all faculties,
Honourable Heads of Institutes of Research of the surrounding universities,
Distinguished all invited speakers and all other speakers,
Distinguished guests,
All participants,
Ladies and gentlemen,

Assalamu' alaikum warrahmatullah wabarakatuh
May peace and God' s blessings be upon you all
Good morning

First of all allow me to extend my warmest greetings and welcome to you all to the 3rd International Conference on Educational Research and Innovation, held by Yogyakarta State to celebrate its 51st anniversary.

Raising the theme – Ethics in High-Quality Research - this conference is designed to discuss the papers on the research findings related to research ethics, and researches on character education, teaching innovations, as well as educational policies. Hopefully, all discussions in this conference can be inspiring and useful for us to improve the quality of education and educational research.

Ladies and gentlemen

For your information, we will proudly present one keynote speech, four plenary presentation sessions and four parallel presentation sessions. Four outstanding speakers in the field of character education and educational research have been invited. They are Christopher Drake from Association for Living Values Education, Hong Kong, Dr. Elizabeth Hartnell-Young from Australian Council of Educational Research, Dr. Mohamed Bahaaeldin from Faculty of Education, Technische Universitat Dresden, Germany, and Dr. Nurul Taufiqurahman, Head of Innovation Center of the Indonesian Institute of Sciences (LIPI), Indonesia.

Ladies and gentlemen

We have done our best to prepare for this conference. So, my highest appreciation and heartfelt thanks to all committee members. As to err is human, shortcomings may

occur here and there. On behalf of the committee, I would therefore like you all to accept our apologies.

At the end of my speech,I would like to kindly request the Rector of Yogyakarta State University to officially open the conference.

To conclude, let me wish you a productive discussion and a fruitful conference.
Thank you very much for your attention.

Wassalamu' alaikum warrahmatullah wabarakatuh.
May peace and God' s blessings be upon you all

Yogyakarta, 6 May, 2015
Head of Research Institute and Community
Service of Yogyakarta State University

Prof. Dr. Anik Ghufron, M.Pd.

FOREWORDS FROM THE HEAD OF COMMITTEE

Assalamu'alaikum wa Rahmatullohi wa Barokatuh
May peace and God's blessings be upon us all

Your Excellency The President of Yogyakarta State University Prof. Dr. Rochmat Wahab, M.Pd, M.A, ladies and gentlemen, good morning and welcome to Yogyakarta State University..

The seminar entitle International Conference on Educational Research and Innovation (ICERI) is held under the umbrella theme of Ethics in High-Quality Research. The seminar is organized by Institute of Research and Community Services, Yogyakarta State University, working together with ACER, LIPI, and University of Dresden. This seminar also dedicated to celebrate the 51st Commemoration of Yogyakarta state university.

Ladies and gentlemen, on behalf of the commitee of this conference, I would like to express highest appreciation and gratitude to the keynote speakers **Prof. Drs. Muhammad Nasir, Akt, M.Si, Ph.D** (Minister of Research, Technology and Higher Education) and four inveted speaker :

- **Christopher Drake**
  (Association for Living Values Education, Hong Kong)
- **Dr. Elizabeth Hatnell-Young**
  (Australian Council for Educational Research, Australia)
- **Dr. Bahaaeldin Mohamed**
  (Faculty of Education, Technische Universitat Dresden, Germany)
- **Dr. Nurul Taufiqu Rahman, M.Eng.**
  (Head of Innovation Center, Indonesian Institute Sciences (LIPI), Indonesia)

The conference is around 200 participant with 121 orally presented article from lecture, researcher, teacher, and student from about 45 universities. The conference is aimed at discussing the papers on the research findings related to research ethics, and researches on character education, teaching innovations, as well as educational policies. It is expected that this conference yields recommendations on the importance of ethics in the research to produce high-quality research for the benefits of the human's welfare.

This conference will be far from succes and we could not accomplish what we do without the support from various parties. So let me extend my deepest gratitude and highest appreciation to all committee members. I would also like to thank each of participants for attending our conference and bringing your expertise to our gathering. Should you find any inconveniences and shortcomings, please accept my sincere apologies. In conclusion, I hope that your discussions produce something useful and very pleasant stay in Yogyakarta.

Wassalamu' alaikum wa Rahmatullohi wa Barokatuh
Thank you

Por. Dr. Sri Atun

TABLE OF CONTENT

DELIVERING SCIENCE-ENGINEERING VIRTUAL LABS USING THE NEW WEB TECHNOLOGIES (HTML5)

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Abstract

This study was a literature review on delevering laboratory experiments through website using HTML5. The website is new web technologies and standards, called HTML5. HTML5 is the newest version of Hyper Text Markup Language (HTML), requiring few requirements for visualization technologies.The technology can enhance effective e-learning media. By using HTML5, internet developes gadually a text-based technology to an object-oriented user interface with dynamic dimension graphics, and all the chances of user interaction. Web visualization can give the significant improvement for virtual laboratories, especially for science and engineering classroom. Visualizations of virtual labs are displayed on the web in the form of plot using HTML5 canvas tag. The plot can be refreshed dynamically. The point of this study is to develop a graphically-interactive simulation application to calculate any issues of natural phenomenon in science-engineering classroom. Therefore, the numerical simulation, user interaction and visualization is consistently executed on the basis of latest web technologies. Finally, the closures of this study are recommendations for the next model of vitual labs and dissemination of the great attributes of HTML5 to build real interactive and dynamic e-learning web application.

Keywords: e-learning, visualization, simulation, HTML5, virtual lab.

1. Introduction

Information and communication technology (ICT) has supported education over the past few years. The term ICT [1]embraces many technologies that enable us to receive information, and to communicate or to exchange information with others. These many technologies (both devices and functions) are capturing, interpreting, storing, and transmitting information.On the other hand, according to Clark and Mayer [2], current learning and training which use the technology continues to increase, while those using conventional or traditional way (face-to-face class) decreases. Still in Clark and Mayer [2], Bernard et al. [3]also compared learning results of electronic open/distance learning and face-to-face learningshowed has no significant difference. Electronic learningor e-learning [1] is appropriate for education because it combines as its name between e- (electronic) and learning, and thus puts an emphasis on learning in a way that the term ICT by itself does not. Where ICT provide the vehicle, e-learning can be described as the journey, with increased knowledge, understanding and skills as the destination. In other words, we use ICT to participate in various electronic learning activities.

E-learning delivered using synchronous or asynchronous ways in several categories. E-learning is using internet for communicating and locating content, within the context of sound pedagogy [1], toaccess e-resources for classroom instruction; to participate in online courses; to provide blended learning by combining online content with other teaching methods; and to offer support for communities of practice to share ideas and experiences. E-resources serve collections of learning resources or materials for the members both using Internet or local networks, like Khan Academy [4], DVB-S based delivery system, the comprehensive encyclopedia Wikipedia [5], dictionaries [6] and thesauri [7], e-books collection of Project Gutenberg [8], and many e-libraries. Online course delivered class through the web using many systems like learning management system (LMS), learning content management system (LCMS), and social learning network (SLN). There are many examples of LMS like Moodle

[9], Dokeos [10], or A-Tutor [11]. The examples of LCMS are Claroline[12] or e-doceo solutions [13]. The examples of SLN are Edmodo [14] and Quipper School [15].

In the blended learning teacher may use the power of web technologies in the course. The tools were provided by web technologiessince the wave of Web 1.0 until Web 2.0. Web 1.0 only serve one-way communication in the static web page. Web 2.0 allow users to create and share information on the web and to collaborate with others interactively using many applications include blogs, wikis, video-sharing, podcasting and social networking [1]. A framework of instructional design proposed by Zheng[16] in designing and developing the Web 2.0-based learning by (a) learner-centered approach, (b) interactive social communication, and (c) dynamic learning in the Web 2.0 applications. In the wave of Web 3.0 [17], applications use semantic technologies augment the underlying Web system's functionalities.

With the support of new web technologies, in addition to presenting the online repositories and/or classes, technology also makes it possible to present a virtual lab class. Virtual lab (or called as Virtulab) is a type of blended learning implementation. Virtulab can be interesting and attractive for students. Virtulab expected to reduce cost of infrastructure, lab. glasswares, lab. tools, and materials in the real laboratory class.As an e-learning application, Virtulab is a form of utilization of specific tools used in practice class or laboratory class such as visualization or simulations. Specialized software including drawing and designing, modelling and simulation, adventure games, expert systems, semantic networking and other interactive learning tools, as well as learning management systems, are often employed to support pedagogical innovation [1]. Virtulab also expected to be complementary other media e-learning and provide multi-modal instruction.Virtulab is very effective media for learning of science-technology, not only because of economic benefit but also of pedagogical benefit, such as providing scientific learning approaches, improving student's learning independence, flexibility, and motivation.

2. Discussion

2.1 Visualization and Simulation in E-Learning

Virtulab presented in visualization and/or simulation forms. Visualization is any technique for creating images, diagrams, or animations to communicate a message; visualization through visual imagery has been an effective way to communicate both abstract and concrete ideas [18].Lateef [19]defined that simulationis a technique for practice and learning that can be applied to many different disciplines and types of trainees; is a technique (not a technology) to replace and amplify real experiences with guided ones, often "immersive" in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion; andthe "immersive" here implies that participants are immersed in a task or setting as if it were the real world.

Visualization and simulation (visim) is considered to have a good role in learning. Visimis generally completed with a game.The game, other than as an effective tool for teaching because it contains the principles of learning[20]. The game can also motivate learning and involves students to make learning process more enjoyable [21].Strangman& Hall [22]stated the gamecouldbe an effective approach to improve students learning.Therefore, Randel[23] reported that the gamewas alsovery beneficial for the development of media oflearning materials related to science and language skills.Pivec[24] found that the visim with the game was successfully applied to formal education, especially in the military, medicine, science, and training.

Visimthat was built as asoftwareapplication can be run in the form of both, desktop-based or web-based visualization and simulation applications. Many kinds of visimhas been used by students or classes, for examples, in assessment of human patient [25],nurse education [26], physics learning games [27], or for computational problem solving [28].

2.2 The Power of HTML5

Web is currently in transition phase to adopt the upcoming HTML5 standard. The web applications are currently supported by the latest technology from the World Wide Web Consortium (W3C), namely HTML5. W3C [29]is an international community that develops open standards to ensure long-term growth of the Web. HTML5 is the new version of HTML (Hyper-Text Markup Language). This standard will replace many of technologies and methods of current web by offering functionality that is currently applied by many ad-hoc solutions.

HTML has been in continuous evolution since it was introduced to Internet in the early 1990s, then HTML4 became a W3C recommendation in 1997. The HTML specification reflects an effort, started in 2004, to

study contemporary HTML implementations and web content. The specification (1) defines a single language called HTML which can be written in HTML syntax and in XML syntax; (2) defines detailed processing models to foster interoperable implementations; (3) improves markup for documents; and (4) introduces markup and APIs for emerging idioms, such as web applications [30].

The HTML5 standard adds many new application program interfaces (APIs), such as location-based services, cross-document messaging and local storage; and features allowing developers to create web applications responding to today's needs [31].HTML has introduced many new APIs and have extended and changed some existing APIs.HTML introduces a number of APIs that help in creating web applications. These can be used together with new elements introduced for applications. For instance, (1) media elements (video and audio*)* have APIs for controlling playback, synchronizing multiple media elements, and timed text tracks; (2) an API for forming constraint validation; (3) an API for commands that user can invoke; (4) an API that enables offline web applications, with an application cache. (4) an API that allows a web application to register itself for certain protocols or media types; (5) editing API in combination with a new global content-editable attribute; (6) drag & drop API in combination with a draggable attribute; (7) an API that exposes the components of the document's URL and allows scripts to navigate, redirect and reload (the Location interface); (8) an API that exposes the session history and allows scripts to update the document's URL without actually navigating; (9) an API for "base64" [32] conversion; (10) an API to schedule timer-based callbacks; (11) an API to prompt the user; (12) an API for printing the document; (13) an API for handling search providers; and (14) the Window object has been defined [33].

2.3 Application Development Sections on Preparing Virtual Lab with HTML5

Basically, the application was made by following three standard stages of software development life cycle (SDLC), such as development, testing, and production [34].Instructors or lecturers or teachers and anyone have possibility to buildsimulation application in web pages with graphics using web programming. Creating a web-based simulation requires basic knowledge of (1) HTMLto provide the structure of the page [35]; (2) CSS or cascading style sheet [36],a visual and aural layouts, for a variety of devices. Along with graphics and scripting, HTML and CSS are the basis of building web pages and web applications; (3) JavaScript [37],a most popular programming language of HTML and the web that can change content, attributes, styles (CSS) of HTML, and can validate data; (4) the HTML5 canvas element [38], which is used to draw graphics on a web page; and (5) HTML controls and link elements [39], to provide keyboard operation and assistive technology interoperability of interactive user interface elements.

Preliminary Section

The first section in creating HTML5-based simulation arefinding requirements or problems to be solved and choosingthe topic of the problems to be presented in simulation. Steps of this section are creating working folder; getting text editor; testingby typing some text contents; addingmarkup; changing the styles; adding a link; and adding the images.

The first step on application development is a space on hard drive, which is required to put working files and folders to be saved. Then, the necessary text-editing application in which the script or code can be written. Text (source) editors [40] intended for use with HTML usually provide syntax highlighting. Templates, toolbars and keyboard shortcuts may quickly insert common HTML elements and structures. Wizards, tooltip prompts and autocompletion may help with common tasks. There are some favorite text editors for programmer. Notepad++ [41] for Windows operating system (OS)or TextWrangler [42]for the Mac OS or Komodo Edit [43] for Linux-based OS is a good choice. Both are free and easy to use by downloading and install it on the computer.This section has created a web page with headings, paragraphs, links, and images, and apply some styling to change the default font, color, and layout.

Second Section

This section includes the following steps on building simulation pages with animated graphics.The steps are (1) adding a place to draw using the HTML5 canvas element; (2) drawing objects in place using JavaScript that can manipulate all objects; (3) Putting the objects in motion by using methods such as: erasing and redrawing the object, changing the values of X and Y position, and approaching a higher-level called retained-mode graphics; (4) puttingthe object and its movement in a mathematical equation; and (5) debugging JavaScript from

errors, such as typographical or other errors. In computing, retained-mode (graphics) rendering is a style for application programming interfaces of graphics libraries, in which the libraries retain a complete model of the objects to be rendered [44].By using competency in JavaScript programming language, HTML5 canvas element, and algorithms to integrate mathematical equation can predict the movement of objects in the simulation.

Third Section

The third section is to provide the user interface. The interface provides the user to control simulation page. Developeror programmer can make a start button, add a slider, and add a numerical readout for the slider. The interface contains Syntaxs [45] not only for buttons and sliders, but also for checkboxes, drop-down menus, and mouse directly (or touch) on canvas.

Finishing Section

The finishing touch section is all about improvement and enrichment. Each of the following improvements can be made independently. Adding a "trails" for this simulation is one of improvement. Canvas can accumulate the amount of unlimited trails, with thousands of single-dots. It is one of the advantages of immediate-mode graphics [46]than retained-mode graphics.Other ways to enrich the simulation that can be delivered through: three-dimensions (3-D) shading by filling the object with a radial gradient; drawing bigger button by choosing the optimum size; styling the slider; fixed-width speed readout; special characters by inserting extra spaces to separate different elements logically; and more tweaks for mobile devices.

2.4 Succesful Project

There are some examples of visualization and simulation development project which was successful enough. In addition to education, visualization projects were also implemented, among others, in the fields of construction; health, geography, biology. In construction, exploring new web technologies (HTML5) was used for engineering applications using the example of an interactive sheet piling wall simulation [47]. In health, the HTML5 was developed for sensor based real-time remote patient monitoring system [48], and a HTML5 powered web electrocardiogram (ECG) management system for telecardiology applications [49]. In geography,HTML5 was used for web geographical information system (GIS) in practice Cartagen[50]. It is an open-source, vector-based, client-side framework for rendering plug-in-free, offline-capable, interactive maps in native HTML5 on a wide range of web browsers and mobile phones, which was developed at MIT Media Lab's Design Ecology group. In biology, the HTML5 was used for an HTML5 Canvas-based graphics library for visualizing genomic data [51], and web-based interactive visualization in a Grid-enabled neuroimaging application[52].

2.5 The Use of HTML5 for Virtual Labs in Science-Technology Learning

The Archimedes law is an the example of the simulation which was developed by HTML5 in this paper. The law stated that any object or body that wee completely or partially submerged into a fluid(liquid), the object would get the force which is equal to the weight of the fluid displaced by the object.

The formula of the Archimedes law is given by Fa = V x g x ρ, where:
Fa : buoyant force
V : the volum of water displaced by object
ρ : spesific mass of water

Authors developed a simulation of an egg as the object which is submerged into the fluid. The egg on the Fig. 1 floats because the spesific mass of the egg was smaller than that of fluid.

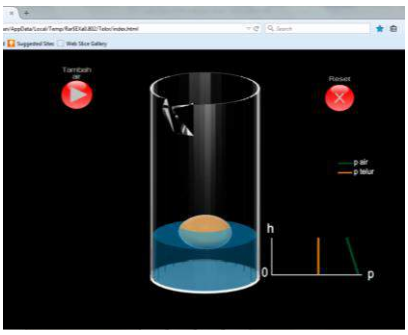

Fig. 1. Floating egg whenρ egg <ρ fluid

Addition of liquid little by little by pressing "play button" results in the increase of volume or mass of the egg submerged in the fluid. However, the addition of the liquid brings about the decrease of spesific mass of the fluid. At the time at which the mass of the egg is equal to the spesific mass of the fluid, the egg float in the fluid (Fig. 2).

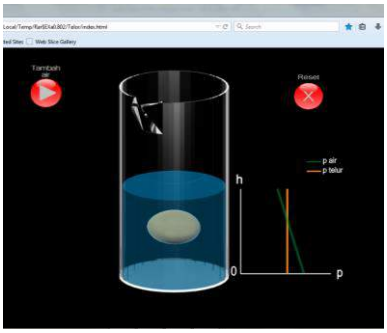

Fig. 2. Floatimg egg in when ρ egg = ρfluid

If the addition of the liquid is continued, then the egg sinks becausemass of the egg is greater than the spesific mass of the fluid (Fig. 3).

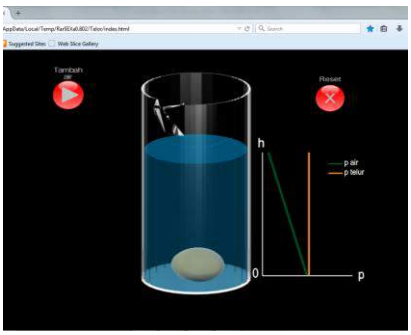

Fig. 3. Sinking egg whenρ egg >ρ fluid

The Archimedes law screen-captured above is an example of simulation that was developed using HTML5. The product waswas interactive and interesting to be good media in learning science and technology. In wider use, HTML5 products of interactive web-based media can be potential for the materials of virtual labs.

3. Conclusionand Suggestion

HTML5 is the newest version of Hyper Text Markup Language (HTML) completed by new application program interfaces (APIs) for visualization and simulation which allow developing interactive web-based games. The properties would be useful for the development of interactive audio-visual web-based games for the simulation of laboratory works. This feature would bring students to have laboratory works through websites that can be accessed anywhere at anytime. The challenges of online courses for science and technology have been faced for many years due to the problems at providing virtual lab can be solved by HTML5.

The use of HTML5 as the virtual lab ofscience and technology is mainly to visualize and stimulate lab works through websites as enrichment lab activities that has yet to be facilitated. It does not mean to replace lab activities because learning Science and Technology is integration of lab works and theory in a classroom. The virtual labs should be useful because it is repeatable, flexible in use and widely accessed.

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