An Effective Interactive Multimedia Taps Software for Solving Engineering Problems

Lee Chen Kang
University Tunku Abdul Rahman (UTAR), Jalan Universiti Bandar Barat, 31900, Kampar, Perak, 31900, Malaysia
leeck82@gmail.com

Manjit Singh Sidu
Universiti Tenaga Nasional, Jalan Serdang, Seksyen 11, Selangor, 43650 Bandar Baru Bangi, MALAYSIA
manjit@uniten.edu.my

Highlights: The application developed for this project has been engineered and customized to anticipate user needs, and have various interactive features built in to allow delivery control and navigation. More specifically, the software is designed to assist the user in learning, visualizing, and problem solving in a step-by-step approach. Such suppleness is important because without it, the package cannot be fully adaptive to the individual users on-going learning, understanding and problem solving needs during instruction.

Key words: Engineering, Problem Solving, Visualization, Multimedia, Interactivity, Mechanics.

Introduction
In knowledge driven era, multimedia has become one of the most attractive and promising technologies in education. For engineering education, one of the common problems faced by the students is the difficulty in visualizing some of the engineering concepts that involved dynamic motions, complex calculations particularly in z-axis. The problems posed to these students usually needs to be solved by using appropriate
formulas and may lead to a series of working steps before obtaining the answer. Present commercial multimedia problem solving software for engineering is incapable of doing so because it do not show all the steps as how the problem was solved. This provides evidence that the student may not learn and visualize the problem. This invention focused on the problem solving and simulation of an engineering software tool by incorporating multimedia and new pedagogical concepts from interactive 2D to 3D environment. The software tool was tested with potential engineering students and instructors from the college of engineering (UNITEN) and the result showed that the interactive simulated multimedia engineering learning tool could assist the Mechanical Engineering students especially the slow learners by enhancing their learning motivation and improved the visualization ability in the topic of relative motion analysis.

Content
Please address as many of the following sections as possible in your paper, as relevant.

1. **Description of your innovation / product development / design / process.** The innovation is an interactive multimedia problem solving tool that guides the user step by step to solve the problem. The product was design using various multimedia software tools and designed based on the ISO 9126 software engineering standards. The software has been tested with over 240 students.

2. **What is the context or background of the innovation / product development / design / process?** User interfaces are important means of communication between user and the product. Effective user interface ensures transfer of
learning has taken place successfully. The innovation has been design in such a way that it is fully user friendly and has effective patterns of interactions. Every each pattern of interaction has been carefully design based on the needs of the problem and users to solve the particular problem. Our design process has helped in simplifying the problem better.

3. **Why are they important to community?** Because the present education system demands higher level of technological tools to be used by students to enhance their learning process. This software tool has significantly benefited engineering students to visualize the problem presented in the software. The students are able to comprehend the problem better and apply the right equations which are otherwise difficult to learn from the static media such as textbook.

4. **Advantages:** The system is fully integrated to be independent of the textbook, such that students attention is not deviated during learning. The questions, objectives, formulas, diagrams and charts are presented in sequential order within the simulation tool. Provide deep interactivity and visualization. As an example, the approach in the simulation tool would be to present the case into manageable steps and the student is prompted for what to do next. Best instructor knowledge is transferred to students. New and tested patterns of interactions which could be easily updated.

5. **Commercialization potential:** The software tool represents an innovative approach in the teaching of Engineering Mechanics Dynamics course. The work is one of the pioneering efforts to address the need for computer based
problem solving software packages for the domain of teaching Engineering in Malaysia and has high value to be commercialized via textbook, direct sales or through secured website.

Table 1: Summary of students’ response generally in learning mechanics dynamics

<table>
<thead>
<tr>
<th>General Question</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Unsure</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>New concepts are the most difficult part of the course. (e.g. the equation of</td>
<td>1 (0.8%)</td>
<td>16 (12.6%)</td>
<td>27 (21.3%)</td>
<td>66 (52%)</td>
<td>17 (13.4%)</td>
</tr>
<tr>
<td>motion, curvilinear motion, relative motion analysis, kinetic energy and etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Working with the textbook</th>
<th>Always</th>
<th>Often</th>
<th>Sometimes</th>
<th>Seldom</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>I understand the material in the textbook.</td>
<td>6 (4.7%)</td>
<td>45 (35.4%)</td>
<td>50 (39.4%)</td>
<td>22 (17.3%)</td>
<td>4 (3.1%)</td>
</tr>
<tr>
<td>I try to do some of the exercises from the text to reinforce my problem-solving techniques.</td>
<td>11 (8.7%)</td>
<td>49 (38.6%)</td>
<td>50 (39.4%)</td>
<td>14 (11%)</td>
<td>3 (2.4%)</td>
</tr>
<tr>
<td>I have problems in understanding the contents because the figure(s) shown is/are static (no animations).</td>
<td>10 (7.9%)</td>
<td>34 (26.8%)</td>
<td>50 (39.4%)</td>
<td>24 (18.9%)</td>
<td>9 (7.1%)</td>
</tr>
<tr>
<td>I have problems in visualize/visualizing the scenario as described in the text.</td>
<td>14 (11%)</td>
<td>24 (18.9%)</td>
<td>58 (45.7%)</td>
<td>27 (21.3%)</td>
<td>4 (3.1%)</td>
</tr>
<tr>
<td>The step-by-step approach shown in the sample solutions was sufficient to aid my understanding.</td>
<td>28 (22%)</td>
<td>37 (29.1%)</td>
<td>51 (40.2%)</td>
<td>8 (6.3%)</td>
<td>3 (2.4%)</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Very Good</td>
<td>Good</td>
<td>Moderate</td>
<td>Bad</td>
<td>Very Bad</td>
</tr>
<tr>
<td>-----------------</td>
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</tr>
<tr>
<td>Overall, I think my level of knowledge for this subject is</td>
<td>4 (3.1%)</td>
<td>44 (34.6%)</td>
<td>70 (55.1%)</td>
<td>8 (6.3%)</td>
<td>1 (0.8%)</td>
</tr>
</tbody>
</table>

Acknowledgement
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References


