Abstract. The aim of this study was to evaluate comparatively three different approach of material used for making 3D topography modelling that need to sink in the water tank to achieved students understanding of topography character through the method. The three-different approach of material used for 3D topography modelling were considered; plasticine modelling, which contains fully 100% plasticine in the process of making the model, half plasticine modelling, which combination between plasticine and Styrofoam as both are in equal quantity materials; and minor plasticine modelling, which the use of plasticine is about 30% and other is using a recycle materials. A comparison of different approach of material used for 3D Model shows the different result in aspects of the model’s resilience, material cost and the rate of sinking in the water tank. Based on the empirical test, the relative performance of the varies material approach use is assessed. From the three-different approach of material uses that we analyses in this study, the minor plasticine 3D modelling is showed the best approach of materials used in the context of knowledge, quality and the process. Moreover, this method more legible in terms of understanding level of topography through the modelmaking. This study intends also to select which 3D models, the students will employ in future assessment for the analysis of understanding through 3D topography model.

Keywords: 3D Model, Plasticine, Recycle, Styrofoam, Topography.

Introduction. In the arly renaissance in Italy, modelmaking evolved into the most important means of architectural representation. Plans (design sketches such as technical plans) and topography models are both means of depicting form and spaces, yet plans convey only two dimensional. Developing Students Understanding on Landform Interpretation through 3D-Modelling Topography sculpture in Water Tank Method requires both learning model making process and understanding the contour line which allows this process to be implemented in the assessment given. Furthermore, seeing the sculpture or target material in-depth, in a moving realistic format can make more enjoyable and excitement towards the learners therefore it’s give more effective and legible explanation towards the subject. (Dalgarno & Lee, 2010). The learning scope covers a very broad domain namely: cognitive (thinking and mind), affective (feeling and emotion) and psychomotor (physical member body). (Abd Rahim Abd Rashid, 2002). Moreover, in era of learning patterns which the recent technology that’s acquired the learners been more creative and critical thinker. The 3D model’s topography sculptured is one of the alternative way and practice in delivering the content and context to the learners by representing the relationship of spatial and visual through experience. It has been agreed by Frisby, J (1980), stated that 3D perspective an alternative method of representing spatial relationship which are requires more inferences to derive depth information about visual scene than stereoscopic presentation and is generally agreed to be less effective in conveying spatial relationship and depth information. Therefore, we developed Students Understanding on Landform Interpretation through 3D-Modelling Topography, which teaches students to understanding the variety character of topography shape within the models were sink in the water tank, applying varied materials and method. Landform and earthworks students should be able to identify characteristic of topography after understanding the contour lines. The characteristic of the contour line is different for the certain shape of topography, for examples, when the contour line is near each other it’s can be define as the steep slope meanwhile when the contour line is far apart it can be called as the gradually slope. Therefore, different material used in modelmaking have been applied in the assessment given to the group of students. In this assignement, the different material used will be evaluated by educators through the assessment breakdown in studied comparing their quality and process. The assessment contains four breakdown which are; content, durability, quality and submission requirements. After the assessment, students were able understanding the character of topography by the shape of contour line that emerge from the model. To do modelmaking, the material selection is very important to produce a superior quality of model. Therefore, through this study, three different or materials been used to identified the more durability, less cost, and student’s understanding on the content during the process. The main material used are plasticine because of the character of flexibility and waterproof availability. Thus, materials that requires for students to use in this assessment are; plasticine, Styrofoam and recycle materials. The group of students are divided into 6 groups which are each two groups of them have a same material (Table 1).

![Table 1](image)

Table 1: The division of varies material to the six (6) groups of students.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Plastecine</td>
<td>A &amp; B</td>
</tr>
<tr>
<td>50% Plastecine +</td>
<td>C &amp; D</td>
</tr>
<tr>
<td>50% Styrofoam</td>
<td>E &amp; F</td>
</tr>
<tr>
<td>30% Plastecine +</td>
<td>-------</td>
</tr>
<tr>
<td>70% recycled</td>
<td>-------</td>
</tr>
<tr>
<td>Materials</td>
<td>-------</td>
</tr>
</tbody>
</table>

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In this assignment students are required to form a group to construct a topographical 3D model that having various and multiples landform consist of major ridge, valley, steepest side slope, flattest side slope, concave slope, convex slope, uniform slope, summit and depression within material selection. The model should be within in size 28 cm (wide) x 40 cm (length) x 30 cm (height). Students also must produce A2 size tracing paper for topography map via AutoCAD software of the site.

**The process. Materials.** According Criss B. Mills (2005) in material selection there need certain criteria to be considered such as the degree of modification and experimenting desired, ability of material to holds its shape and the requirements of durability for the model. In this study, student required to focusing on the durability of the purpose of the model whereas the model need to be water resistant for the acquires to sink in the water tank. Therefore material selection for the finishes need to be waterproof and hold the shape of the model. In previous semester, students build or making a topography model using plasticine and Styrofoam to shape the form. Plasticine is widely used in the analysis of metal forming processes, due to its excellent material flow ability. This is because plasticine can produce a large material flow after being subjected to force and through the material flow, and it’s quite costly for the students. Plasticine, the most widely used soft modeling material, which shows elastic-plastic flow behavior and excellent material flow ability, has been successfully used as a convenient model material to simulate plastic deformation.

![Plasticine](image1.png)

**Fig. 1** Plasticine is waterproof material for model making with a variety colors and easy to hold the shape.

Foam or Styrofoam molded board is one of the material that students use in modelmaking especially in topography model. The form and character are easily to cut and convenient to handle and can be shape according the contour line make it easier to use as material. Even though the foam is easily to shape, the lighten weight make it quite difficult to sink the model in the water tank as per requirement of the learning process in the topic.

![Styrofoam](image2.png)

**Fig. 2**: Styrofoam is the material with light weight and easily to cut to the shape we need.

The last material that been use in this study is the recycle materials. In this study, paper and bottles are chosen because its easily get especially for the students who are studying in studio base. Drawing paper that been rejected been recycling to do this assignment. The recycle materials that students use is zero cost and its easily to get shape like the plasticine. Figure 3 shows the material that been use purposely for this study.

![Recycle Materials](image3.png)

**Fig. 3**: Styrofoam is the material with light weight and easily to cut to the shape we need.
Through the selection of the materials, each of the materials have its own criteria either its advantage or this advantage in the model makings for this study. Therefore, in the context of this study, Table 2 below show the comparison between each material due to the assessment criteria.

Table 2 Comparison relation between different materials and the cost, durability and ability to sink in the water tank.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Cost</th>
<th>Durability</th>
<th>Sink in the water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasticine</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Foam/ Stryofoam</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Recycle material</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Table 2 shows the relations between the materials and the consideration aspect which are cost, durability and the level sink in the water. From the table, the comparison is based on the survey and questionnaires to the students. The material durability is proven by the experiment in class and sink in the water are based on the study of availability of the material with the water reaction. Therefore, in this study comparative of the material need to be analyses whereas to identified the best material to comply all the requirement of the assessment yet it less costly and achieves the learning outcome.

**Methods.** To solve the above issues, we divided the students into a six (6) group with a different material yet applying the same method in model making. 100% plasticine are given as materials for Group A and Group B. Meanwhile for Group C & D are given 50% plasticine and 50% foam or Stryofoam yet the last two group which are Group E and Group F are required to used 30% plasticine and 70% recycled material used such as bottle, paper, etc. This learning technique is called as reverse study which are the students learn and understanding the characteristic of topography from 3D to 2D. Previously, the students are required to understand the characteristic of the contour line from the plan which are 2D into the model making which are 3D. According to the study by Barnet & Ceci (2002), the core of educational policy is transferring of learning across content from 2D to 3D which are the context be able in development of abstract thinking and development of a flexible representational. Each group are required to use only the given material to form a topography model within the size given. Through the process model making, the study identified with the size of model that need to build, the number of plasticine box that use are different for each group of materials. Table 3 shows the identified data for the material that use in the model making. This data will be discussed further in the discussions based on the cost and the impact into students learning process.

The Topography model must contain all the elements or character of topography that needed to be form and shape. The element that need to shape are Summit, Valley, Major Ridge, Concave, Convex, Depression, Uniform Slope, Steep Slope and Flat Slope. The process of model making is given between 2 weeks to 3 weeks. During this period is the process to understanding the topography criteria through the model. Each of the group have a varied materials and different approach to build the topography. The different is occur based on the material used. From the observation in class, the students are easier to learn the theory given through the practical exercise. Learning using your psychomotor is more attachable and memorable for the students. The students learn from the mistakes that made through the process of discussion session with the educators. Learning from the backwards is one of the alternative way to make the students more understanding because nowadays, according the observation and study in the class, students are often to see the result before knowing the process.

**Fig. 4**: The process model making using 100% plasticine as materials.
Fig. 4: The process model making using 50% plasticine and 50% Styrofoam / foam as materials.

Fig. 5: The process model making using 30% plasticine and 70% recycled material.

After the complete in model making, students required to put their model into the water tank given. The finishing touch of the model making is the students required to make sure the model is waterproof to put in the water tank. Moreover, nine (9) elements of topography must form accordingly to the theory and based on the discussion with the educators. To put in the water tanks is the important part in the study because its reflect on the understanding of student about the assessment.

Fig. 6: The completion 3D model Topography with nine (9) elements that required in this study; Summit, Valley, Major Ridge, Concave, Convex, Depression, Uniform Slope, Steep Slope and Flat Slope.

The next step is the model to be sink in the water. Water need to pour into the water tank slowly and step by step for every 50mm depth. Then when the water stops at the certain height, students requires to mark or draw the line of the water that appear at the surface of the model. The steps continue until the whole of the model is sink. To accomplished this process, the challenge that been aspect is the quality, durability, and the sink level of the model. After it complete draw the contour line at the surface of the model, its need to be trace and produce a technical drawing using CAD application to form a 2D drawing. From this 2D drawing the students will more understand the shape of certain contour for the specific character. For example, the ridge in 3D model shows a contour line with a ‘V’ shape that pointed to the lowest elevation in the 2D drawing. Through this process of sink in the water is the part where the selection material must be suitable and give the impact into the learning process. At the end of the process, students are required to produce 2D drawing from the 3D model to identified and understanding the relations between contour line and the shape of the elements topography.
Fig. 6: The 2D technical Drawing that had been produce by CAD application after the 3D model Topography was sank in the water tank.

From the figure above, it shows the level of understanding students by labelling the nine (9) elements of topography character based on the development of modelmaking were accurate. From this 2D drawing, it can be proven the relationship between the contour line (2D) and the shape of the topography (3D) are connection. Moreover, to achieved this result, the material used for the 3D model topography is very important because the finishing of the model need to waterproof, water resistant and can hold the shape long lasting even been sank in the water.

**Result & discussion.** Every material has a different characteristic, advantage and disadvantage. In this comparative study, three materials are being comparison to identified the best material used that suitable for the students need yet giving the legible understanding in the assessment process. Table 3 shows the result of the material used in the model making to achieved a better understanding in identified characteristic of the topography and yet gives and advantage to the students. Due to the process and method that been applied in the assessment, the data have been collect in the context of used of material, the challenge have been faced and the input together with the learning outcome that have been achieved. Therefore, with these the data collection and result it have been hypothesis whereas the selection material is one of the aspect that can help students to have a better understanding towards the topic learning.

Table 4: The comparative study between material and the criteria needed

<table>
<thead>
<tr>
<th>GROUP</th>
<th>MATERIAL</th>
<th>COST</th>
<th>DURABILITY</th>
<th>SINK IN THE WATER</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>100% Plasticine</td>
<td>RM 84.30</td>
<td>Medium</td>
<td>Excellent</td>
<td>96 boxes of plasticine</td>
</tr>
<tr>
<td>Group B</td>
<td>50% Plasticine + 50% Foam / Styrofoam</td>
<td>RM 95.90</td>
<td>Medium</td>
<td>Excellent</td>
<td>103 boxes of plasticine</td>
</tr>
<tr>
<td>Group C</td>
<td>30% Plasticine + 70% recycled materials</td>
<td>RM 49.50</td>
<td>High</td>
<td>Excellent</td>
<td>8 boxes of plasticine</td>
</tr>
<tr>
<td>Group D</td>
<td>30% Plasticine + 70% recycled materials</td>
<td>RM 51.30</td>
<td>High</td>
<td>Excellent</td>
<td>14 boxes of plasticine</td>
</tr>
</tbody>
</table>

At the above table comparison result of the material used for each topography model, shows the Group C and Group D is the costliest than the other group of varied materials. The costly can be identified from the material that they used which are the plasticine and the foam both are expensive. However, in the context of durability and the ability to sink in the water each of them is medium and weak. Meanwhile for the Group A and Group B, the cost and the durability at the stage medium but for the ability to sink in the water is excellent. The last material that used in this comparative study is the 30% plasticine and 70% recycled materials where each of the two Group E and Group F shows the best model material used whereas the less cost with high durability and excellent ability to sink in the water.

The challenged either advantage or disadvantage also have been identified during the process. Varied materials facing a different challenged in the process of learning and understanding. From the presentation and Question and Answer session, each group of material share their challenge while doing the process. For the Group A & B their challenge is on finding the material of plasticine. It is because of the demanding is higher than supplying at the store nearby. In the context of time frame and workmanship, it can be done on time and the plasticine easily to hold n shape. Meanwhile group B & C, together agreed the challenge that their face is cost and the difficulties to sink it the model in the water because of the low density of the model. Moreover, in the context
of to shape the topography is more look stiff and not natural look. Finally, for group E & group F, the challenged that they face is time frame. It takes too long to get the shape of topography to dried yet, it gives time for them to understanding each phase of the process and it make them better in understanding. This comparative study is aiming to evaluate comparatively three different approach of material used for making 3D topography modelling that need to sink in the water tank to achieved students understanding of topography character through the method. Therefore, after the process, the assessment was evaluating. The evaluation is based on the learning outcome through the assessment rubric. Table 5 show the evaluation for each group based on the assessment rubric; Content, Durability, Technical graphic and requirements.

![Result Assignment 1](image)

From the results, it shows the group that using 30% plasticine and 70% recycled materials getting the highest mark in this assessment. Therefore, it can be evaluated the level of understanding student from the group E & group F is better and plus they can produce a good technical drawing of 2D drawing using AutoCAD software application with all the labelling of the elements topography and indicate the level of the elevation contour lines. Its due to the knowledge about the contour lines and the understanding. Meanwhile, the two other groups of materials also, have a give their best it just there is the certain criteria they can’t achieved perfectly score. The slightly difference between Group 100% Plasticine and group 30% Plasticine + 70% recycled materials are the durability. Overall, from this result, the aim of the study has been achieved and its shows, the different advantages and disadvantage of three different material that use and how each of them gives an impact in learning process and achieving the learning outcome of the topic.

**Conclusion.** It can be concluded from research finding of comparatively study, selection of materials for modelmaking 3D topography are important to developed students understanding through the process. Each of materials have their advantages and disadvantages in developing the understanding and knowledge. From the results and discussions, it shows that the materials of 30% plasticine with 70% recycled material approach was successfully reinforce understanding to 2nd semester of landscape architecture students in UiTM Cawangan Perak. This is because process was used as teaching aid to promote the interactive collaboration learning managed to enhance the understanding on landform interpretation.

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**References**

8. Ideally, the names of all authors should be provided, but the usage of “et al” in long author lists will also be accepted: