

THE KIDS CALCULATOR: WHAT'S YOUR FOOTPRINT?

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ABSTRACT

There are various ways to reduce the amount of CO₂ emission. This paper investigates the effectiveness of using a medium which is an interactive web based carbon footprint calculator for kids called CFCKids. CFCKids is developed to allow children to calculate their carbon footprint based on their daily activities that contribute to the emission of carbon dioxide (CO₂) for educational purposes. CFCKids also provides information about climate change and tips to reduce carbon footprint. Evaluation on usability and content had been conducted with children aged ten to twelve years old. From the findings, it has been discovered that CFCKids can increase the knowledge of children about climate change and how they can naturalize the environment from the result of their carbon footprint calculation.

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1.0 INTRODUCTION

Climate change is a global issue that will affect human lives (Kadarudin et al. 2008). All parts of the world will be affected by the risk of climate change phenomena. Based on the report by The National Oceanic and Atmospheric Administration (2007), the warmest period was recorded between the end of 20th and the beginning of the 21st century. If this situation continuously occurs, it will risk human lives. The increasing earth's temperature will destroy a variety of life forms on it, which is called as biodiversity. Carbon dioxide is the most significant greenhouse gas generated by humans (Starazdin & Skeat, 2011). Excessive CO₂ will trap heat in the atmosphere and that will lead to greenhouse effect and the earth's surface temperature will also be increased.

Climate change is a global issue. Therefore, Malaysia has made an initiative whereby we are committed to reduce our carbon footprint, by reducing 40 per cent emission of CO₂ by the year 2020 compared to the 2005 level (Cheng, 2013). The Prime Minister of Malaysia, Datuk Seri Mohd Najib (2013) also had mentioned the importance of reducing carbon footprint where he encouraged all citizens to be part of it. To achieve the country's mission, all of us must take part to reduce and to naturalize our carbon footprint. Thus, the statement has become the motivation in carrying out this project as one of the efforts to response to the climate change issue in looking into creating awareness among Malaysians. Carbon footprint is a measure of carbon dioxide (CO₂) that is based on the total amount emission associated with an activity (Wiedmann & Minx, 2008). In this paper, activities are related to all actions that involve in the area of children's education age range 10-12 such as at school, tuition and at home would be calculated.

Children are a group that is mostly affected by climate change risks such as environmental health hazards (Strazdins & Skeat, 2011). So, it is very important to expose and create awareness of sustainable environment at a young age. Currently, there are many mediums and platforms that have been used to deliver information about climate change such as newspapers, television, social media, radio and others. However, by using only these mediums to deliver the information, there will be a group that will fall behind and not getting it, which are children. Sometimes, the word or terms were used can be difficult for them to understand. To increase their awareness and educate them about climate change, a specific approach can be taken to make sure that they will get the right information and thus increase their knowledge about climate change.

The focus of this project is to develop an interactive web application to calculate carbon footprint that is convenient and easy to be understood by children. This application was designed for children aged range 10 to 12 years old. However, it could also be used by students in secondary schools because it covers their daily educational aspect. This application was developed to calculate children's carbon footprint based on their daily educational activities that contribute to the emission of carbon dioxide (CO₂). The application also allows users to print out the report of their carbon footprint. The principle of Children Computer Interaction (CCI) was used as the design guideline for children in the development of this project prototype.

2.0 RELATED WORK

The significance of this research is to educate people, especially children, about climate change issues and make them become more knowledgeable in protecting the

environment. In order to inculcate children's awareness, a web application is developed as a medium to show them such a complex issue in a more attractive and appealing way to attract their attention. In this way, they are able to see the impact of their lifestyle on the environment by calculating their own carbon footprint. This paper will also benefit each individual who wants to know about carbon footprint, and it will be beneficial to a group of students that can use this study as one of the resources in increasing their knowledge in sustainable environment.

2.1 Carbon footprint

Carbon footprint is a measure of carbon dioxide (CO₂) based on the total amount emission which is associated with an activity (Wiedmann & Minx, 2008). In United Kingdom, a demand for carbon footprint calculator over the past few years has been increasing due to climate change issue. In Malaysia carbon footprint calculator is still new. In the year 2011, Forest Research Institute Malaysia (FRIM) is one of the organizations that calculate its annual carbon footprint, with the aim to eliminate the waste of energy and reduce operational cost (FRIM, 2012). This is supported by Fredolin (2012) who claims that research in climate change in science and surrounding regions still has a wide gap (Fredolin et al., 2012).

Carbon footprint is appropriate and necessary for the current situation because almost all human activities contribute to emission of carbon dioxide. Without carbon footprint calculation, people will not know the impact that it can contribute to the environment that leads to the risk of climate change (Abbott, 2008).

3.0 CARBON FOOTPRINT CALCULATOR

A carbon calculator was closely linked with carbon footprint. Hunter and Waters (2009), define that a carbon calculator estimates carbon footprint. They also agree that carbon footprint calculator measures the emission of greenhouse gases to determine the amount or quantity of greenhouse gases that was produced for a specified year. Each country has a different amount of emission factor and the emission factor may change. The average efficiency for specific power plants (conservative method) was used as a determinant for formula to calculate CO₂ emission (Greentech, 2013).

According to Clark (2012), there are many existing carbon calculator and evolving standards for calculating carbon footprint, but he agrees that there is no precision in calculating carbon footprint. However, the result of the calculation using different web sites can vary widely depending on the formula that they use (Clark, 2012).

In this project, the carbon calculator formula, as shown in Table 1, has been adapted from Green Campus Initiative's (GCI), a project done by UCSI University in showing their commitment in reducing the risk of climate change (Keoy et al., 2011). The diagram in Figure 1 shows the factors that contribute to the calculation of carbon emission based on daily educational activities of children that use electricity, fuel, paper, plastic, bottle and can. This calculation is applied in CFCKids application.

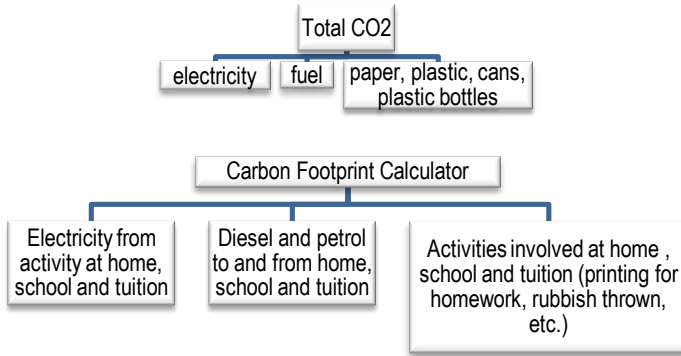


Figure 1: Carbon Footprint Calculation

Table 1: Carbon Footprint Formula Adopted from UCSI University's (Keoy et al., 2011)

| Variables | Carbon Footprint Formula | Notes |
|-------------|--|---|
| Electricity | $CO_2 = AME * EEF$ <ul style="list-style-type: none"> ▪ AME : Average Monthly Electricity used (kWh) ▪ EEF : Electricity Emission Factor (CO₂e/kWh) | It is better to use the average EEF of West Malaysia 0.585 CO ₂ e/mWh |
| Fuel | $CO_2 = AMF * FEF$ <ul style="list-style-type: none"> ▪ AMF : Average monthly Fuel used (Liters) ▪ FEF : Fuel Emission Factor (CO₂e/Kg) | <ul style="list-style-type: none"> ▪ Every liter of gasoline releases 2.5 Kg of CO₂ ▪ Every liter of diesel releases 2.85 kg of CO₂ |

| | | |
|-------|---|--|
| Paper | $\text{CO}_2 = \text{AMP} * \text{PEF}$ <ul style="list-style-type: none"> ▪ AMP : Average Monthly Paper used (Kg) ▪ PEF : Paper Emission Factor (CO₂e/Kg) | <ul style="list-style-type: none"> ▪ 1 Kg of virgin paper produces 3.24 Kg of CO₂ ▪ 1 Kg of recycled paper produces 1.76 Kg of CO₂ ▪ The weight of one A4 standard paper is 5 gram. |
|-------|---|--|

4.0 FINDINGS

The interface for CFCKids was constructed based on the design principle guideline for children. The interactive web of CFCKids application was designed and developed by applying images and animation and has less text to cater to the needs of children who has less interest to learn about a complex issue such as climate change. Figure 2 shows the main page of CFCKids web application.

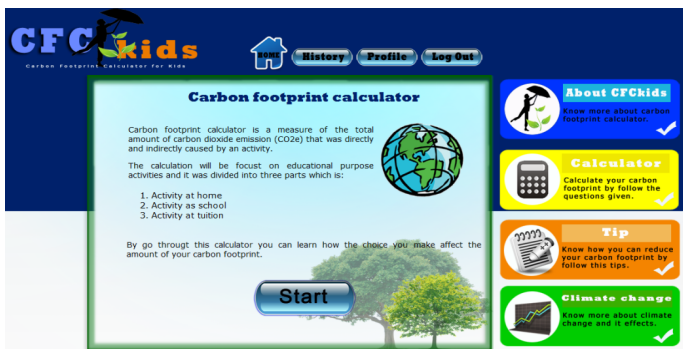


Figure 2: Main Page for CFCKids

After all necessary information has been included, the result page of carbon footprint will appear after the user clicks the “Result” button. This page it will display the total amount of carbon footprint based on kids’ daily activities for educational purposes that contribute to the emission of carbon dioxide. Besides that, users can also view weekly and monthly total amount of carbon footprint (Figure 3).

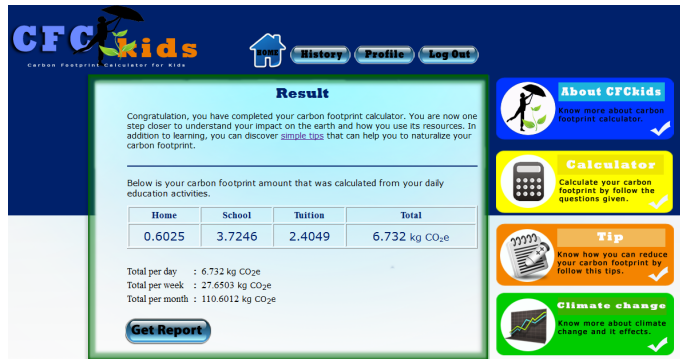


Figure 3: Result Page

A post-test evaluation had been conducted by distributing questionnaires to fifteen respondents aged 10-12 years old. Participants evaluated the web application after they themselves experienced the CFCKids’ application. Several questions were asked to measure their understanding regarding climate change issue and how the carbon footprint calculator managed to increase their understanding and how the result of their carbon footprint calculation affected their daily life.

4.1 Awareness about Climate Change

Most of the participants have shown improvement on basic knowledge about climate change issues with 50% increment compared to before they used the CFCKids application. However, there are 17% of espondent, that still did not get the idea even after they used CFCKids application. One of the respondents said that he read all the content about climate change in the CFCKids but he does not really understand it because the words and sentence were difficult for him to understand. However, 83% of respondent find that the content of the climate change is easy to be understood. This difference may have occured due to the participants' reading skills and language.

4.2 Carbon Dioxide Emissions and Carbon Footprint

The evaluation results show that 58% of respondents claimed that they knew about how CO₂ is produced after they used CFCKids. From this finding, it shows that the information on CO₂ that is provided in CFCKids managed to increase the understanding of the children. This is important because proper knowledge about CO₂ made it is easy for them to figure out their carbon footprint calculation result.

It is interesting to know that after the calculation has been made, 83% of participants agreed that they are eager to see how their daily activities contribute to carbon dioxide emission. Others still could not figure out the purpose of the calculation results. This may happen due to the lack of explanation about carbon footprint in CFCKids. In CFCKids, there is not much information that provides a detailed explanation about carbon footprint compared to climate change, greenhouse effect and carbon dioxide.

Consequently, this project has managed to create awareness to most of the children that participated. The feedback gained is invaluable as the participants stated that it is important to protect the environment because every action

that they take can contribute to carbon emissions that will lead to climate change. A fruitful discussion has also been carried out by the researcher and participants on a complex issue such as climate change actually is very new and vague to them. A lot of questions were asked, and finally the researcher managed to leave the participants on a knowledge that they have ignored before.

5.0 CONCLUSION

CFCKids is a web based application that functions as a medium to educate people, especially children, about climate change. The main objective of this study is to evaluate the effectiveness of carbon footprint calculator on children. The strength of CFCKids lies in the carbon footprint calculator which allows users to calculate their carbon footprint. The challenging part in this research is to get the formula of carbon footprint based on Malaysian scenario. Even though there are many carbon footprint calculators that are available in the Internet, CFCKids is developed for children in Malaysia, which highlights carbon emission based on children's daily activities on educational purposes. It is recommended that this project can be enhanced by adding other features such as games, chatting room that allows children to communicate and discuss their carbon footprint result and also allow for interface customization.

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