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# Hand-in No. 1

## Scientific Methodology, IMT4110

This essay will attempt to analyse and explain some of the underlying scientific methods used in the two papers "Kansas is flatter than a pancake" by Fonstad, Pugatch and Vogt, and "Portable devices as visual noise in lectures" by Volden, Leiknes and Røise.

In the first paper, the authors state clearly the purpose of the study; to find the answer to the question "Is Kansas is flatter than a pancake?". The independent variable - or the variable that represents the potential reason for variation - is Kansas. One could also say that the pancake in question is also an independent variable, as it too is an input variable. The dependent variable - or the variable that we intend to measure - is a measure of flatness. If we envision a simple equation, one could consider  $x$  and  $y$  to be Kansas and the pancake, whilst  $z$  was a measure of flatness.

The authors make a solid effort in operationalizing the terms, or making the variables measurable. They use the flattening ratio  $f = (a - b) / a$ , which if a surface is perfectly flat, should produce a ratio of  $f = 1$ . Using a sample strip from one pancake, calculating its elevation points, and comparing its elevation model to data collected for the state of Kansas, they could conclude that Kansas is indeed flatter than a pancake. In terms of answering their single, simple question, the terms operationalized seem to suffice. One could argue however, whether other methods of determining flatness should have also been employed, e.g. using an appropriate extraction strategy (rectangular, polar, points..) from the entire plane would be more appropriate than measuring the profile of one single sample strip of the pancake, compared to only the West-East profile of Kansas.

This brings up the question of reliability and validity. The measurements done in the study seem mathematically sound and reliable, and the results themselves do indicate internal

validity: the question is indeed answered and the variables are controlled and measured in an appropriate manner. One could not say, however, that the study has good external validity. The study may not have produced the same result if measured with a different pancake for example. This brings back the question of operationalization. The researchers have not indicated what type of pancake this is. Maybe this could be an additional variable? Surely the type of pancake: e.g. a traditional Norwegian pancake, a crêpe, a blini, and its raising agent (baking powder, yeast) would affect its flatness profile.

Another issue is the fact that the authors have only used a single pancake in their experiment. To get more reliable results, a decent sized sample would be required, and their means would need to be calculated. There are sure to be some outliers in the sample, as various environmental factors such as heat of the frying pan, the type of pancake, how long the pancake mixture has been set aside, and even the person making the pancake could affect its outcome. An additional thought is to consider all these low-phase variables before making their conclusions. Does e.g. the thickness of the batter affect its flatness? Does the amount of butter in the pan reduce friction, thus leading to a flatter pancake? A lot of questions can be asked, and the experiment is in essence, a simple experiment meant for fun. Even if it is inherently quite flawed, it does answer the question it set out to answer.

In the second paper, attitudes towards computer usage in a classroom setting were investigated. The independent variable here would be the use of a computer in a classroom setting. The dependent variable that we want to measure is the level of visual noise, or even dissatisfaction in the use of computers in a classroom setting. The study was conducted as a questionnaire delivered to students in various classrooms, in two separate years; 2007 and 2011.

The terms to be operationalized would be the questions in the questionnaire themselves, such as "Entertainment-use of computers is very disturbing", which when done in a sample, could be a measure of whether computer use is problematic, or a measure of dissatisfaction. For the purpose of this study, the sample size seems adequate, and the researchers have tried to eliminate bias to ensure validity of the results.

One attempt to increase the reliability of the results, and to make sure the variables were operationalized properly, was that the students were unaware of the experiment, until they were given the questionnaire. This way they could reduce potential bias introduced by

the respondents if they were given enough time to reflect thoroughly on the questions; they had the issues in question "fresh in mind" so to speak. Potential factors such as some students then "planning" not to bring, or to bring their computers to class on the particular day the questionnaire was to be answered, for example, would be eliminated. The respondents also didn't have time to mature through education and reading up on the issue beforehand, which could make the experiment flawed. Although not mentioned in the paper, one potential factor to consider when writing the survey, is to account for whether the students had heard of the survey in any way. Rumours could flourish, and if the experiment was done over a period of several days, the answers to be affected by bias. If the survey was done at the same time in different classes though - or within a very short timeframe - this could not be seen as an influencing factor.

Regarding reliability and validity - although not clear whether this was used from the article - the use of a control group could be a way to improve the validity of the results. One could imagine using the same (or similar) questionnaire with a group of students who weren't using a computer at all during a class. This could give us a baseline sentiment towards computer usage in general, without the roles of "users" and "non-users". By manipulating the independent variable (by introducing computers in other classes), we could possibly see what effect this has on our dependent variable (dissatisfaction or visual noise).

In terms of validity, the experiment appears to have high internal validity. The data sample is quite large, the questions are relevant and delivered to the entire group, and the conclusions can quite easily be made. The respondents in general do not see computer use in class as problematic. Computer use for non-academic/entertainment purposes however, is clearly seen as problematic amongst non-users.

To achieve external validity - could this research question be transferrable to handheld (mobile) devices for example? The results would indicate so, but a quantitative investigation into this would be interesting. As the results of the paper indicate that people do not mind computer usage during class for academic purposes - as screen size of a mobile device is often limited - the question whether people use the device for mainly non-academic purposes rises. The acceptance for mobile use in class might therefore be even lower than for computer usage, as it quite often might be seen as a work tool. Some sources indicate that less than 25%

of all US consumers' mobile internet usage falls in the categories "browser", "productivity" and "utilities", whilst the rest in general falls into categories such as "social media", "media", "lifestyle", "music" and "entertainment". It would be safe to say that measuring sentiment towards mobile usage would be relevant and would be a high-phase variable to consider.

The study mentions it also could be transferrable to e.g. workplace situations, which brings in another question: does the situation itself alter perceptions on how usage is perceived? The study specifies that computer usage in 2011 as compared to 2007 had increased as a matter of choice; the respondents chose to use the computer to a greater extend. Could one expect that in a mostly computer-based workplace, that acceptance towards computer usage for work-related tasks in meetings and such would be even greater? Does age have any affect as a variable here? Older generations might perceive computer usage as more disturbing or negative than younger generations (and students).

Sources:

<https://techcrunch.com/2017/03/03/u-s-consumers-now-spend-5-hours-per-day-on-mobile-devices/?guccounter=1>