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Student Research Report

The Effectiveness of Informative Educational Video in Promoting Zero Waste

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Executive Summary
UBC has formed a guideline for restaurateurs/students to consult. Recently, an educational video modeled on the guidelines was produced as a new way to promote Zero Waste on campus. Our research question focuses on examining whether watching the environmental education video version of Zero Waste Food Strategy Guideline can be more effective, in terms of obtaining a higher accuracy rate on our designed survey, than reading the text-based version of the Guideline. We randomly sorted 159 participants into three conditions; video, guidelines and control and measured their responses on a survey designed to test their knowledge on accurate waste sorting practices for cups, cutlery and containers. Our results showed that the educational video can only significantly improve the accuracy of UBC students as compared to both guideline and control conditions in the containers question, but not in the cups and the cutlery questions. There are some limitations in our study including potential confounding variables, a limited number of samples and a weak variety of population. In the end, we gave our client a recommendation on combining guideline and video together to promote the Zero Waste Strategy.

Introduction
Bio plastic/ compostable plastics contribute to the majority of the waste contamination on UBC campus. Although it sounds like an alternative to conventional plastic, over half of them do not break down in composting facilities. As stated in Zero Waste Action Plan (2014), UBC has launched a program to engage the Vancouver (Point Grey) campus community in developing a Zero Waste Action Plan. The implementation of this plan is expected to transit the UBC campus towards a Zero Waste community. The goals of Zero Waste focus on: "designing and managing products and processes systematically to eliminate the waste and materials, conserve and recover all resources and not burn or bury them" (Zaman, 2017). The SEEDS program offers the written format of Zero Waste Food Strategy Guideline, along with a video version of the guideline for the public to clarify the requirements of the food ware procurement guideline. The findings in Garber's (1990) research indicate that less error occurs while encoding visual themes (19% error rate) compared to verbal or written text (36% error rate), which means that the emergence of educational videos could have a higher success rate than the guidelines for our client. Secondly, video technology has emerged as a powerful platform for documenting richer, vivid, and complex cases (Wang & Hartley, 2003), due its advantage in transforming indirect knowledge (which is difficult to transcribe to text) to a clear description through the use of images (Hartsell & Yuen, 2006). Extensive research has shown the effectiveness of video education in the field of education. The study conducted by Hartsell and Yuen (2006) highlights the ability of video in creating an emotional connection with the audience. Due to its ability to transmit emotions to the audience, video plays an effective role in promoting motivation and effective learning among students. Besides, video education provides a "dual-channel learning" for students (Cruse, 2006). It is known that people get information in three main ways: visual, auditory, and tactile. Unlike text or verbal content, video conveys information from both visual and auditory sensory pathways and it is delivered in combining different modes which means that video is delivering the same amount of information while through two different channels simultaneously (Cruse, 2006).

Psychological Insight
The research conducted by Strokes (2002) proposed that pictures/images are beneficial to guide and enhance learners' comprehension ability, and it is confirmed that the use of visual elements

has achieved success in improving learning efficiency/ grades. In particular, the test scores are even higher when the teaching adopts text + graphic format. An alternative explanation for why visual information can improve students' understanding is that visual stimuli involve a more detailed processing which causes people to generally find visual stimuli more interesting and engaging than verbal text (Graber, 1990). On account of the richness of visual information and its difficulty to be systematized (as compared to text, verbal information), visual information is therefore more likely to be reprocessed and accurately recalled (Graber,1990). Based on existing knowledge about the positive effects of visual information on test achievement, we are especially interested in examining whether watching an environmental education video about "Zero Waste Food Strategy", in comparison to its' guideline version (written format), would help UBC students to better improve the accuracy of identifying the recyclable & compostable food ware provided by food outlets. We hypothesized that educational video will improve the accuracy of UBC students in identifying recyclable & compostable food ware as compared to the guideline and control condition.

Methods

Participants. The prescribed sample size is 159 participants, which was obtained by G power calculation. The link of the survey was sent to UBC students and alumni via social media platforms such as Messenger. 64.8% of the participants are female, and 35% of them are male (see Figure A1). The average age of our participants is around 22 years old, which made up nearly 90% of the participants. On the other hand, 8.8% of our participants aged around 30 years old. Lastly, we have 1.3% of the sample being 45 years old above and 0.6% of the participants aged around 18 (see Figure A2).

Conditions. The study is a between-subject design, and the experiment will include three conditions. The first one is the "educational video condition" where the participants are asked to watch a 4-minute long video. The educational video will include audiovisual information about UBC's Zero Waste Food Ware Strategy, a guideline that contains instructions about how to reduce single use items and transition toward recyclable and compostable food ware such as cups, cutlery and containers (see Appendix B). The second is the "guideline condition" where the participants are asked to read the text-based version of the video, which consists of specific instructions as presented by our SEEDS Client (see Appendix B). The last condition is the control condition, where participants are directed to the survey without prior exposure to the video or guideline and are asked to answer multiple-choice questions.

Measures. In order to measure the dependent variables, the survey consists of 5 questions (see Appendix B). The first 3 multiple-choice questions aim to measure the accuracy of the answers regarding the content and sorting process outlined by the guideline and video, or if they are in the control condition, then without either. For example, the first question is *"What kind of cups should you buy for your cafe?"*, which requires the participant to select all the correct answers to measure which condition provides the more accurate answers (see Appendix B). The last 2 are demographic questions and are employed to measure variables such as gender and age. For example, we will ask the participant to select the age range among 5 choices (see Appendix B). These questions aim to test whether the results on the answers will be differentiated by gender and age.

Procedure. Due to the outbreak of COVID-19, we adopted online data collection to avoid contact with crowds. The survey questions were distributed in the Qualtrics platform, and 159 participants were recruited to complete the survey. Online data collection was difficult to proceed because the prescribed sample size was big, which took over 3 weeks to complete. In order to recruit enough participants, we sent links generated through the Qualtrics to social media platforms such as Messenger, and we also tried to share the link with both friends at UBC and other students' social media groups. All participants were asked to first sign a consent form; there were 51 participants recruited in Video condition who were asked to "imagine you are the manager of a UBC cafeteria, a part of your job is to purchase food ware for the café (e.g., containers, cups)." Next, they watched a 4-minute long video, and finally they completed the survey. There were 52 participants in the Guideline condition and were provided the same information, but through a written format. Once they read the guidelines, they were asked to complete the survey. The 56 participants of the control group would directly complete the survey without watching video or reading guidelines. The survey was supposed to be completed within 15 minutes, which varied by conditions because reading guidelines could take longer. All answers would be gathered and calculated out the scores, which are our dependent variables used for data analysis.

Results

We first calculated the accuracy score for each of the 159 participants, with a simple formula (# of correct answers / total # of correct answers) - (# of wrong answers / total # of wrong answers). We organized the data into a table with participant number, condition, question, and accuracy score, which was used in our final analysis on the JASP software. A one-way between groups ANOVA was conducted to compare the effect of ways of communication on UBC students' accuracy scores for the 3 questions (cups, cutlery, and containers) in control, guideline and video conditions. First, there was a significant effect of ways of communication on students' accuracy for the cup question at the $p < .05$ level for the three conditions, $F(2,156) = 22.08$, $p = .001$, $\eta^2 = .22$ (see Table C1). Post hoc comparisons using the Tukey's *HSD* test indicated that students' accuracy scores in the video condition ($M = 0.62$, $SD = 0.48$) were significantly higher than students' accuracy scores in the control condition ($M = 0.13$, $SD = 0.38$) ($p < .001$) (see Table C2 & C3). Students in the guideline condition also had significantly higher accuracy scores ($M = 0.61$, $SD = 0.46$) than those in the control condition ($p < .001$) (see Table C2 & C3). However, there was no significant difference between the accuracy scores of students in the video and guideline conditions ($p = .998$) and it contradicted our prediction (see Table C3). Based on the F-table, we determined our F_{crit} is larger than 3.06 and smaller than 3.04. Since $F(2,156) = 22.08$ is greater than the F_{crit}, we will reject the null hypothesis. Our results suggest that both the guideline and video can significantly improve students' accuracy scores for the cups question.

Similarly, our statistics revealed a significant main effect of ways of communication on students' accuracy scores for the cutlery question, $F(2,156) = 6.81$, $p = .001$, $\eta^2 = .08$ (see Table D1). Post hoc analyses indicated that the accuracy scores of students in the video condition ($M = 0.71$, $SD = 0.25$) were significantly higher than the accuracy scores of students in the control condition ($M = 0.42$, $SD = 0.58$) ($p = .004$) (see Table D2 & D3). Also, students in the guideline condition had significantly higher accuracy scores ($M = 0.69$, $SD = 0.46$) than those in the control condition ($p = .007$) (see Table D2 & D3). This highlights that both the guideline and video have significant effects on students' accuracy scores for the cutlery question. Because $F(2,156)$ in this question is also greater than F_{crit}, we will reject the null hypothesis. In short, our hypothesis is still partially

supported since we expected the video condition to be significantly different from both control and guideline conditions.

In terms of the container question, we found a significant main effect of ways of communication on students' accuracy scores, $F(2,156) = 5.33$, $p = .006$, $\eta^2 = .06$ (see Table E1). Post hoc comparisons using Tukey's test indicated that the accuracy scores of students in the video condition ($M = 0.60$, $SD = 0.37$) were significantly higher than the accuracy scores of students in the control condition ($M = 0.38$, $SD = 0.33$) ($p = .006$) (see Table E2 & E3). We also found that the accuracy scores in the video condition ($M = 0.60$, $SD = 0.37$) were significantly higher than the accuracy scores in the guideline condition ($M = 0.43$, $SD = 0.39$) ($p = .046$) (see Table E2 & E3). $F(2,156)$ in this question is also greater than F_{crit}, we will reject the null hypothesis in this question. As a result, these findings suggest that the showing of educational video had a positive effect on students' accuracy for all 3 questions, while the guideline in the document format was only effective for the cups and cutlery questions.

Taken together, the results for the cups and cutlery questions are not in line with our hypothesis as there was no significant difference between the video and guideline conditions. However, it should be noted that the educational video can significantly improve the accuracy of UBC students in identifying reusable food ware as compared to control condition.

Discussion

The data in the first cup question indicates that participants who watched the educational video and/or read the guideline performed better on identifying recyclable cups since there is no significant difference between the accuracy result for video and guideline condition. The result in the second cutleries question also suggests a similar finding. One of the possible explanations for this finding is our inability to control whether our participants will fully understand or read our video and guidelines. Although our questions can directly reflect how well our participants can perform through each condition, we failed to ensure our participants finished watching the video or reading the entire guidelines document. With regards to the guidelines, it is possible that our participants might not have finished reading the 16 pages worth of the information, due to boredom or other time constraints. Thus, these confounding variables can potentially influence our result. For future studies, we can break up the guidelines into virtual flashcards so that the participants have to click through each before getting to the final survey. We also think that it would be important to provide a locked time limit before they can move on to the next part.

Our study gave us an opportunity to observe how the educational video can lead to a better score among other conditions within an environmental education topic. In addition, our study can also provide recommendations on the most efficient method of delivering messages to more students and business owners. Future research can be conducted in a larger population, since our population is limited with only 159 participants which would in turn, increase the external validity of the study. Another drawback of our research is nearly 90% of our participants are around 22 years old, and they are mostly university students. This phenomenon can cause a weak variety within our population. Moreover, our educational video and guideline are mainly for store or restaurant owners, which means they are most likely older than 22 years old. Therefore, further research is needed to aim at a higher sample size and more variety of population.

Based on our observation on the result, it is noticeable that educational video improves the accuracy of how participants answer our question. In accordance with our findings, some other studies also found that teaching students through TV or video can increase students' motivation for learning (Cruse, 2006). As we previously mentioned, video education can bring both visual and auditory sensory, it is possible that watching some footage or pictures from our educational video can reinforce participants' memories (Cruse, 2006). At the same time, it might also impact participants' emotion as suggested in Hartsell and Yuen's study (2006). For example, the pictures of the recycle items might visually help participants memorize the correct items, and the footage as the bulldozer cleaning tons of garbage can possibly bring emotional impact to participants. It is also worth suggesting that in order to transform our short-term memory retention to a long-term memory retention, future research can bring out more dramatic footage such as how pollution is detrimental to our natural environment and human beings, and can help the audience realize the consequence if we do not recycle properly.

Recommendations

Our client's goals as per the Zero Waste Strategy included increasing awareness with regards to waste sorting and the differences between reusable, recyclable and compostable materials. Therefore, the overall aim was to continue ongoing reduction in waste disposal at UBC. As for our findings with regards to which participants are more likely to engage in appropriate waste sorting, we found that as per Graber et al. (1990), information retention is successful through video teaching to better systematize and accurately recall facts and instructions compared to verbal or written information, which was supported by our data.

With this in mind, our results demonstrated significant results with the video and guideline conditions when considering two out of three criteria, however for the container question, the video condition was the only one that demonstrated a significant result. Therefore, in order to reach these goals, we recommend moving forward with a combination of guidelines and video conditions. Additionally, the video condition we demonstrated was geared towards managers and those who took the survey within our sample were asked to hypothetically position themselves as being in charge of waste disposal and sorting. We further recommend altering the video such that it is provided as digestible content and geared towards students. Our clients could also incorporate strategies and policies where showing the video is a requirement during the orientation or initial period of every year through their RAs, in dining halls or in some classes. There, we suggest that the video condition be the primary focus for providing awareness on the topic at hand, together with written information.

Lastly, in order to ensure appropriate waste disposal, we also recommend considering existing sustainable strategies that use incentives to encourage individuals to decrease their waste sorting process. Restaurant or grocery owners could label their cups, containers, and cutlery with 'recyclable', 'reusable', 'garbage' or even 'paper', 'plastic', 'cans' etc. as pertaining to sorting bins within UBC. For UBC students who sort their waste appropriately, they can take an image engaging with the correct waste disposal and receive a free meal, drink or a workshop hosted by the AMS or other organizations of UBC. This way, the students are motivated to appropriately sort their waste and ensure that our client can reach their 2021 and all future goals.

References

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Appendix A

Contribution of Each Team Member:

Yuki Liu: Yuki is responsible for finding related academic research papers, writing literature review, introducing the motivation and background of our study, explaining the psychological insight in our project and stating the research question and the hypothesis of our study.

Xueying Liuxu (Susy): Susy is responsible for providing information of the participants, describing the conditions, variables as well as measures in the research design, and explaining the procedure of our study.

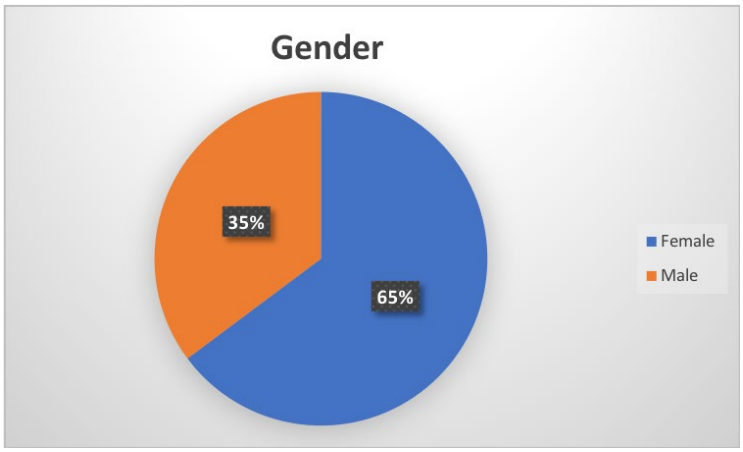
Wenqi Fan (Kitty): Kitty is responsible for reporting the results of our study, explaining the statistical analyses performed on the obtained data, describing the specific findings with graphs and tables, and explaining the significance of the results as they relate to the hypothesis.

Xuan Chen (Allen): Allen is responsible for discussing the results of the research, describing the limitations and challenges in our study design, and discussing the relevance to environmental sustainability and further implications of our research.

Nishika Kulkarni: Nishika is responsible for describing the implications we found in our study, explaining the contribution of our project, suggesting recommendations for our UBC client based on the effectiveness of the video, and providing realistic action plans.

Figure A1

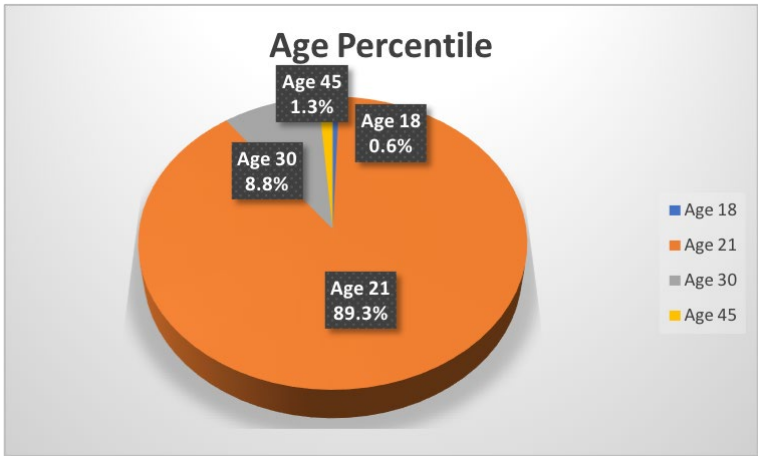
The Gender Ratio of Participants



Note. n=159

Figure A2

The Age Ratio of Participants



Note. n=159

Appendix B

Qualtrics Survey

Q1
What kind of cups should you buy for your cafe? (select all that apply)

- 
- recyclable plastic cups 7
  
- recyclable plastic cups 5
  
- recyclable plastic cups 3
  
- recyclable plastic cups 2
  
- recyclable plastic cups 6
  
- compostable cups
  
- foam cups
  

Q2
What kind of cutleries should you buy for your cafe ? (select all that apply)

- wood & bamboo 
- plastic cutleries (including recyclable, compostable and PLA) 
- plant fibre-based cutleries 

Q3

What kind of containers should you buy for your cafe ? (select all that apply)

- plain, uncoated paper containers 
- styrofoam containers 
- compostable/biodegradable plastic containers 
- certified compostable coating containers 

- conventional plastic containers 

- reusable containers

Q4
What is your gender?

- Male
- Female
- Non-binary / third gender
- Prefer not to say

Q5

What is your age?

- Below 18
- 18-24
- 25-34
- 35-44
- Above 45

Video link: https://m.youtube.com/watch?v=SY1Tx54HKAs&feature=youtu.be

Guideline link: https://planning.ubc.ca/sites/default/files/2020-01/UBC%20Zero%20Waste%20Food%20Ware%20Strategy.pdf

Survey link: **https://ubc.ca1.qualtrics.com/jfe/form/SV_e4Xlq1LFDkvUAqW**

Appendix C

Table C1

The ANOVA Results of UBC Students' Accuracy for the Cups Question (Q1)

ANOVA

ANOVA - Q1_cups

Cases	Sum of Squares	df	Mean Square	F	p	η_p^2
Conditions	8.440	2	4.220	22.083	< .001	0.221
Residuals	29.812	156	0.191			

Note. Type III Sum of Squares

*$p < .05$

Table C2

The Descriptive Results of the 3 Conditions for the Cups Question (Q1)

Descriptives

Descriptives - Q1_cups

Conditions	Mean	SD	N
control condition	0.133	0.375	56
guideline condition	0.613	0.457	52
video condition	0.618	0.478	51

Table C3

Post Hoc Comparisons Using the Tukey's HSD Test for the Cups Question (Q1)

Post Hoc Tests

Standard

Post Hoc Comparisons - Conditions

		Mean Difference	SE	t	p_{tukey}
control, condition	video, condition	−0.485	0.085	−5.733	< .001
	guideline, condition	−0.480	0.084	−5.697	< .001
video, condition	guideline, condition	0.005	0.086	0.064	0.998

Note. P-value adjusted for comparing a family of 3

*$p < .05$

Appendix D

Table D1

The ANOVA Result of UBC Students' Accuracy for the Cutlery Question (Q2)

ANOVA

ANOVA - Q2_cutleries

Cases	Sum of Squares	df	Mean Square	F	p	η_p^2
Conditions	2.806	2	1.403	6.809	0.001	0.080
Residuals	32.145	156	0.206			

Note. Type III Sum of Squares

*$p < .05$

Table D2

The Descriptive Result of the 3 Conditions for the Cutlery Question (Q2)

Descriptives

Descriptives - Q2_cutleries

Conditions	Mean	SD	N
control condition	0.420	0.578	56
guideline condition	0.689	0.457	52
video condition	0.706	0.249	51

Table D3

Post Hoc Comparisons Using the Tukey's HSD Test for the Cutlery Question (Q2)

Post Hoc Tests

Standard

Post Hoc Comparisons - Conditions

		Mean Difference	SE	t	p_{tukey}
control, condition	video, condition	−0.286	0.088	−3.258	0.004
	guideline, condition	−0.269	0.087	−3.082	0.007
video, condition	guideline, condition	0.017	0.089	0.188	0.981

Note. P-value adjusted for comparing a family of 3

*$p < .05$

Appendix E

Table E1

The ANOVA Result of UBC Students' Accuracy for the Containers Question (Q3)

ANOVA

ANOVA - Q3_containers

Cases	Sum of Squares	df	Mean Square	F	p	η_p^2
Conditions	1.408	2	0.704	5.325	0.006	0.064
Residuals	20.628	156	0.132			

Note. Type III Sum of Squares

*$p < .05$

Table E2

The Descriptive Result of the 3 Conditions for the Containers Question (Q3)

Descriptives ▼

Descriptives - Q3_containers ▼

Conditions	Mean	SD	N
control condition	0.381	0.327	56
guideline condition	0.430	0.392	52
video condition	0.601	0.371	51

Table E3

Post Hoc Comparisons Using the Tukey's HSD Test for the Containers Question (Q3)

Post Hoc Tests

Standard

Post Hoc Comparisons - Conditions

		Mean Difference	SE	t	p_{tukey}
control, condition	video, condition	−0.220	0.070	−3.131	0.006
	guideline, condition	−0.049	0.070	−0.694	0.767
video, condition	guideline, condition	0.172	0.072	2.397	0.046

Note. P-value adjusted for comparing a family of 3

*$p < .05$