# Interactive Digital Kitchen: The impact on Language learning

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**Abstract**. This study aims to investigate the usability of a newly developed technology – the Digital Kitchen – as compared to a normal everyday kitchen to teach English vocabulary. This interactive kitchen which was first developed to help people with dementia is equipped with sensors and different wireless communication technologies which allows it to give step-by-step cooking instructions and verbal feedbacks to the users. In this study, the task-based learning teaching (TBLT) approach was brought into the real world instead of the artificial real-world activities carried out in classrooms. Altogether, 54 intermediate level English learners took part in this study. They were divided into experimental and control group with one group using the Digital Kitchen and the other group in a normal kitchen setting. Working in pairs, they cooked 'Apple Crumble' (a traditional English recipe). After cooking, an immediate post-test was administered to find out whether vocabulary learning had taken place in the one hour cooking session. Feedback from the participants was also documented using open ended questionnaires. Additionally, a delayed post-test was carried out 10 days after the experiment to check whether the words learnt were retained. We will discuss the quantitative findings of this study to determine the impact of the technology on vocabulary learning.

**Keywords**: digital technology, instrumented kitchen, vocabulary, task-based.

## 1. Introduction

Over the past 30 years, many drastic changes have occurred in the field of education where technology is concerned. Advances in digital technologies are changing the profession of English language teaching and applied linguistics. In fact, it is predicted that in the next decade, as universities and colleges respond to global, social, political, technological, and learning research trends, the practices of teaching and learning will undergo a technology revolution (Siemens & Tittenberger, 2009).

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One new invention that has a high possibility to benefit language learners is the Ambient Kitchen* which was first developed to help people with dementia. As it is equipped with sensors and different wireless communication technologies, the kitchen can speak and provide helpful hints to its users. In order to be used as a learning tool, the kitchen was then equipped with more gadgets that could be utilised to meet pedagogical goals. For example, more accelerometers are attached to the utensils and the containers of the ingredients to allow the kitchen to monitor the activities of its users. The ubiquitous computing makes it possible for the kitchen to give step by step cooking instructions and at the same time allow the users to have control of the process through the interface displayed on a touch screen. They can either request for a repetition which would also give them the written text of the instruction, skip or go back to certain instructions.

Funded by the Engineering and Physical Sciences Research Council (EPSRC) Digital Economy Programme on "Research in the Wild: Getting research out there", the brand new Digital Kitchen was built for the French Kitchen Project** and is still undergoing some technical enhancements. Theoretically, the project aims to develop the next generation of technology applied to language teaching, namely the use of digital sensors together with a task-based learning approach.

Hypothetically, it is assumed that when the same task is carried out in a normal everyday kitchen, the outcomes may not be the same as when the tasks are carried out in the interactive Digital Kitchen. It can also be assumed that the Digital Kitchen, just like the other technological tools employed in teaching should be able to produce better learning outcomes. However, in reality, how much 'more' can the Digital Kitchen offer when compared to a normal everyday kitchen?

The research intends to evaluate and determine the impact of incorporating technology in tasks designed for vocabulary teaching. Therefore, the intent of this comparative experimental study is to test the usability of the Digital Kitchen as a tool in a task-based approach to facilitate vocabulary learning. Based on one cooking session, this study hopes to find out the difference in the learners' achievement when the same task is carried out in the interactive Digital Kitchen as compared to the real life setting (normal everyday kitchen).

## 2. Method

### 2.1. Participants

Participation was voluntary. 54 intermediate level English learners from the INTO Programme of Newcastle University who have been in the United Kingdom for not more than 6 months took part in this study. These students are academically

* The Ambient Kitchen project is available at http://culturelab.ncl.ac.uk/research/digital-interaction/ambient-kitchen-cels

** The French Digital Kitchen project is available at https://digitalinstitute.ncl.ac.uk/ilablearn/kitchen

qualified students who have already been accepted into a university undergraduate or postgraduate course. They were chosen for two main reasons: 1) They have limited English vocabulary, and 2) besides academic reasons, they are learning English to be able to communicate in everyday life tasks.

### 2.2. Procedure

The participants were divided into experimental and control groups with one group using the Digital Kitchen and the other group in a normal kitchen setting. When the project started, the participants came in pairs and were first asked to do a pre-test. Next, prior to cooking, the participants watched a video showing the food being prepared (highlighting the ingredients and utensils involved). Later, they cooked a traditional English recipe which was 'Apple Crumble'. The experimental group followed instructions from the system and the control group was given a printed recipe. A laptop was also provided for the learners to seek online help. After the cooking activity, they completed a set of vocabulary exercises as a post-task. Immediate post-test was then administered to find out whether vocabulary learning had taken place in the one hour cooking session. Feedback from the participants was also documented using open ended questionnaires. Also, a delayed post-test was carried out ten days after the experiment to check whether the words learnt could be retained.

### 2.3. Methodological framework

The task-based learning teaching approach was employed whereby TBLT was brought into the real world (Ellis, 2003) instead of the artificial real-world activities carried out in normal classrooms. In designing the vocabulary task, the involvement load hypothesis (Hulstijn & Laufer, 2001) was also being taken into account to ensure vocabulary learning opportunities.

### 2.4. Data analysis

In order to quantify our data, we used the SPSS software. Independent t-tests and sample paired t-tests were carried out to get the results of between group and within group performances in the pre-, post- and delayed tests.

#### *2.4.1. The tests scores: comparison within group*

Table 1 shows that the mean score of the experimental group pre-test and post-test were 7.39 and 17.6 respectively, with a level of significance value of 0.00 ($t$ = - 24.02, $df$ = 27, $p$ < .05). This confirmed that the difference in the students' performance after the intervention is highly significant. Meanwhile, the mean score of the control group pre-test was 7.27 and of the post-test was at 15.65. In fact, the difference between the two means was also statistically significant ($t$ = - 16.58, $df$ = 25, $p$ < .05). This depicts that the control group test scores also improved although they were not exposed to the Digital Kitchen.

Table 1. Significance of difference between mean scores of Experimental and Control group on pre-test, post-test and delayed test (raw data)

| Group | Test | N | M | SD | t-test for equality of means | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Mean difference | t value | df | p value |
| Experimental | Pretest | 28 | 7.39 | 2.39 | 10.22 | 24.02 | 27 | 0.00 |
| | Post-test | 28 | 17.61 | 2.35 | | | | |
| Control | Pretest | 26 | 7.27 | 2.65 | 8.38 | 16.58 | 25 | 0.00 |
| | Post-test | 26 | 15.65 | 3.62 | | | | |
| Experimental | Post-test | 28 | 17.61 | 2.35 | 1.40 | 4.16 | 27 | 0.00 |
| | Delayed | 28 | 16.21 | 2.33 | | | | |
| Control | Post-test | 26 | 15.65 | 3.62 | 1.84 | 4.59 | 25 | 0.00 |
| | Delayed | 26 | 13.81 | 3.76 | | | | |

The paired sample t-test was then run on each group's post- and delayed test results to find out whether the same results found in the earlier test maintained the same. However, both the experimental and comparison group results show that the participants have lost some of the words that they have learnt. For the comparison group, it is significant ($t = 4.16$, $df = 25$, $p < .05$) with a post-test mean of 17.61 as compared to 16.21 for the delayed test. The experimental group had significant results ($t = 4.58$, $df = 27$, $p < .05$), with a post-test mean of 15.65 and 13.81 for the delayed test. These results demonstrate that both groups changed to a statistically significant extent.

### *2.4.2. The tests scores: comparison between groups*

Table 2. Significance of difference between mean scores of experimental group and control group on the actual post-test scores (post- minus pre-test scores)

| Group | N | M | SD | t-test for equality of means | | | |
|---|---|---|---|---|---|---|---|
| | | | | MD | t value | df | p value |
| Experimental | 28 | 10.21 | 2.41 | | | | |
| Control | 26 | 8.38 | 2.53 | 1.83 | 2.78 | 52 | 0.007 |

Table 2 depicts that the mean score for the experimental group was higher than the control group ($t = 2.78$, $df = 52$, $p < .05$) with a mean difference of 1.83. This means that the difference in the test scores was significant and therefore, we can conclude that the experimental group performed better than the control group in the post-test.

Table 3. Significance of difference between mean scores of experimental group and control group on the actual delayed test scores (delayed minus pre-test scores)

| Group | N | M | SD | t-test for equality of means | | | |
|---|---|---|---|---|---|---|---|
| | | | | MD | t value | df | p value |
| Experimental | 28 | 8.82 | 2.04 | | | | |
| Control | 26 | 6.54 | 3.04 | 2.28 | 3.26 | 52 | 0.002 |

Table 3 reveals that the mean score of the experimental group was 6.54 and that of the control group was 8.82 on the actual delayed test scores. The mean difference was 2.28 with the $p$ value .002 which shows that there was a statistically significant difference ($t = -3.26$, $df = 52$, $p > .05$) between the two groups. Hence, this confirmed that the

learners in the experimental group had acquired more lexical items than those in the control group. The result above also shows the overall performance of both groups in the experiments. This indicates that the experimental group has performed significantly better throughout the experiment.

*2.4.3. The open-ended questionnaire (experimental group)*

100% of the students enjoyed the session. 82% said the task was easy. 14% claimed it was neither easy nor hard but one student (3.6%) thought that it was 'a bit difficult'. All of them claimed that they had learnt new words and five stated that they had learnt instruction patterns too. Only 53% of them reported that they had used the online dictionary/websites to look for meaning of words. 100% of them claimed that they could follow the instructions and believed that the activity could help them learn English. 64% of them turned to the interface, 21% on both interface and cooking partner, the rest on online dictionary/website and the interface when faced with difficulty.

## 3. Conclusion

The purpose of this study was to find out the impact of the Digital Kitchen to vocabulary learning. Based on the results of the tests scores, the Digital Kitchen does have an impact on the students' achievement. The overall performance of the experimental group was better than the control group throughout the experiment. However, as the statistical analysis is only data for the findings, we will need to look at the details of the students' feedback and also the video recording in order to understand why this happened. We need to get some insight into how the students interact among themselves and the digital system that would help them to learn more words than those who did not experience the technology.

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