**LEVELS 7/8 DESIGN AND TECHNOLOGIES ACTIVITY**

**Let’s Order Lunch**

**Introduction to Numeracy in Design and Technologies**

In the Victorian Curriculum area of Design and Technologies, there are several outcomes for which students are required to have both numeracy and mathematical skills. Numeracy is evident in all three sub-strands in Design and Technologies, which are:

* Technologies and Society
* Technologies Contexts
* Creating Designed Solutions

In Design and Technology learning, students need numeracy skills to be able to engage in exploring, creating, and evaluating designs in which technology is incorporated.

In each of these three sub-strands, students employ sophisticated numeracy skills in order to interrogate technology-enhanced designs and create their own data-informed designs. Students engage in real-world scenarios and explore data sets such as, user numbers or frequency of access to physical or virtual spaces. Strong numeracy skills are required for students to make informed decisions about the effectiveness of designs.

**Technologies and Society**

In this sub-strand, students explore factors that influence how technologies meet the needs of various demographic groups. In achieving these learning outcomes, students will need to draw on numeracy skills to find and explore data to answer their questions. Students then need to be able to use their knowledge of statistics to decide whether the proposed design has met the needs of the intended audience. Students also need to be able to explore different ways that data are presented.

For example, in reviewing the design of a website for an audience of visually impaired learners, students may discover that the ‘website map’ page is comparatively under-used. A closer inspection of the data might reveal that the text is presented in a difficult-to-read font. If students compare the usage statistics for different pages, they may discover a clear preference for a design that better meets the needs of visually impaired learners. Students might use numeracy skills to question the reliability of this type of data, and look at the amount of time spent in each area of the website. Students need to demonstrate a flexible and informed approach to working with data.

**Technologies Contexts**

In this sub-strand, students analyse designs and processes within the contexts of food and fibre production, engineering systems, and materials specialities. As the term ‘analyse’ implies, students are asked to make sense of complex systems and data sets in order to demonstrate their understanding of data. To be successful in the learning outcomes for this sub-strand, students need to be able to interpret a wide range of graphs, charts, and diagrams that represent abstract concepts, such as computer networks or manufacturing cycles.

**Creating Designed Solutions**

In this sub-strand, students investigate, generate, produce, evaluate, and create solutions to complex problems. In designing these solutions, technology is used to frame, design, and/or implement the strategies. Key skills for students to achieve these outcomes include the ability to make sense of statistics and data, find locations, and interpret and create maps and plans. Finally, students need to seek feedback on their designs.

Hence, strong numeracy skills, underpinned by well-developed mathematical understandings, are inextricably linked to Design and Technologies in the Victorian Curriculum.

**Developing Numeracy Understanding in Design and Technologies**

In the Victorian Curriculum: Design and Technologies, teachers are required to provide students with a range of learning experiences in which students demonstrate design processes, use technologies, and employ numeracy skills. Location and position are crucial numeracy skills that are used to make sense of design and technologies in a range of settings, such as understanding the location of factories near the required primary resources (geographic location) or designing a mobile app for users with physical limitations (the positioning of buttons on the screen).

In order to support students’ numeracy development in design and technologies, it is important to:

* Expose students to a range of learning contexts in which students engage with technological and design challenges. Teachers should expose students to a range of physical and virtual contexts to ensure that students can transfer their understanding between these different spaces. In these contexts, numerical data will be presented various ways. Hence, students need to be able to make sense of these presentations of data. Teachers should dedicate time to exploring the relative benefits and challenges of different types of data and when and how they might be best used.
* Clearly elucidate the numeracy skills that are required to make sense of data and statistics. Interpreting statistics requires students to demonstrate specific numeracy skills that students may not be confident applying to real-world problems. Teachers need to provide examples of how data might be interpreted or used to justify a claim. In co-creating and evaluating technology-enabled designs, teachers can develop students’ ability to analyse and evaluate their design proposals.
* Explain key mathematical terminology. There may be terms that students are unfamiliar using outside the mathematics classroom. The teacher should seek to normalise the use of terms such as statistics, mean, median, and mode, so that students are confident in their ability to apply mathematical skills and understandings in the Design and Technology classroom. Teachers should consider engaging students in the development of a glossary of key terms for use in the classroom.
* Provide access to design and technology challenges in which students are engaged in authentic problem-solving. Teachers are guided by the curriculum documents to bridge the gap between abstract design concepts and numeracy skills. This means that teachers need to provide engaging and complex learning activities (Schooner et al., 2017). Ensuring that design challenges and examples are authentically linked to students’ experiences beyond school can support deeper engagement and learning (Brookes, 2017).

**Lesson Plan: Let’s Order Lunch**

In this lesson, students will investigate how the design of digital objects is often informed by data. Students will make sense of usage data from an app and will work to understand the role that probability has in design and how understanding data enables us to make informed predications about how people will use technology.

In this lesson, students explore the use of an app at a secondary school. Parents, teachers, and students use the app to pre-order their lunches from the canteen, but the school leaders have received some complaints that the app is hard to use and offers too many options. The school leaders would like to reduce the number of lunch options on the app and need to better understand what families are likely to order. Students will employ the concepts of design and probability to generate a recommendation for the school leaders.

The students’ task is to explore the usage data from the app. These data provide information about which items are ordered and when orders are placed during the day.

The lesson is designed to take up to one 90-minute period but can be separated into smaller lessons if required.

**Prerequisite/Corequisite Knowledge: Design and Technologies**

* Knowledge of how to use an application on a mobile device
* Understanding that data are collected each time that a mobile app is used
* Ability to find patterns in data sets and to create column graphs

**Background Mathematical Skills and Understandings**

Teachers of Design and Technologies are not expected to teach the mathematical knowledge and skills that students will draw on when engaging with this activity. The students will have learnt and should be adept with the required mathematical knowledge and skills to complete the activity. According to the Victorian Curriculum Mathematics, the required mathematical knowledge and skills should have been developed in earlier years of schooling, that is, by the end of Level 6.

For this activity, the background mathematical knowledge and skills needed are:

* Knowledge of time expressed in 24-hour digital format
* Describe and interpret data presented in digital media form (Excel spreadsheet)
* Extract and tally pertinent data (from an Excel spreadsheet) to obtain frequency counts.

N.B. If the ‘filter’ function in Excel is to be used, the students may need assistance in using it.

* Record (tallied) data in tabular form
* Display tallied data in column graphs (with or without the use of technology)
* Interpret and compare data displays
* Pattern identification

**Lesson Description**

1. Begin by sharing screenshots of a lunch order app. Explain that families use this app to pre-order students’ lunches, and that there have been some complaints about how the app works. [See here for an example](https://www.schoollunchonline.com.au/) if your school does not use one. Explain that all apps collect data, and that the data that are extracted from an app can be analysed to inform the app’s design. Discuss the school leaders’ wish to reduce the lunch menu. Therefore, an understanding of which items are the least popular is needed. Students also need to know which items are most popular so that they can highlight them on the homepage of the app.
2. First, students will explore the data to understand how the app is currently used. Provide the data to students in a spreadsheet. You can download [sample data](https://drive.google.com/file/d/17wbnTi6PYxT-ZynrhoDZEkifBHVelrFA/view?usp=sharing) here. Students will spend 10–15 minutes exploring the data using MS Excel. Based on the provided data, how should the app be laid out? What should be on the first page? What should be on the last page?
3. Lead students to write basic statements about the data, asking questions such as:

* Are there any patterns that emerge?
* What stands out to you at the moment?
* What is the least popular food item ordered overall?
* Which time of day is most popular to order lunch?

1. Students will then work in small groups or pairs to create two column graphs that represent the number of times that each type of food was ordered on each of the two days.
2. Using their column graphs, students should next be supported to identify other patterns:

* Most popular food each day
* Least popular food each day
* The top five most popular types of food

1. In small groups or in pairs, students will prepare a report in which they present, to their peers and the teacher, their suggestions for the revised design of the app. Students should use their initial data analysis to suggest which items should appear on the front page of the app:

* On a Tuesday morning
* On a Tuesday afternoon
* On a Thursday morning
* On a Thursday afternoon

1. To complete the lesson, the students will share their proposed redesigns with their classmates. The teacher could set up stations around the room for each small group or pair and half the class could move between the stations while the others remain with their station. In this way, each group has the opportunity to present and to attend presentations. After the presentations, a final class discussion, led by the teacher, will involve students voting for the most convincing and effective proposal.

**Table 1: Links to the Victorian Curriculum – Design and Technologies**

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| Strand and Sub-Strand  (if applicable) | Content Description (Code) | Elaboration(s) |
| **Design and Technologies**   * Technologies and Society | Explain how designed solutions evolve with consideration of preferred futures and the impact of emerging technologies on design decisions  (VCDSTS055) |  |
| **Creating Designed Solutions**   * Generating | Apply design thinking, creativity, and innovation and enterprise skills to develop, modify and communicate design ideas of increasing sophistication  (VCDSCD061) | Using techniques including combining and modifying ideas and exploring functionality to generate solution concepts |

**Table 2: Links to the 21st Century Numeracy Model (Goos et al., 2014)**

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| Aspect of the Model | How This Aspect is Addressed by the Lesson |
| **Attention to Real-Life Contexts**   * Citizenship * Work * Personal and Social Life | Students explore real-world data and are given opportunities to identify ways to improve an existing design of an app. Namely, students explore data from a lunch order app to identify what types of food are most popular. Students will be guided to consider their school’s lunch order process and to investigate data, taken from another school’s lunch order app, to make informed judgments about how best to improve the app’s design. |
| **Application of Mathematical Knowledge**   * Problem Solving * Estimation * Concepts * Skills | Students analyse the provided data in order to understand usage patterns for a lunch order app. Students create column graphs to represent the data so that they can more easily compare the frequencies. |
| **Use of Tools**   * Physical * Representational * Digital | Students use MS Excel, a digital tool, to analyse data and create column graphs, a representational tool. By exploring the data in a table and in column graphs, students are exposed to two different representations of the data set. |
| **Promotion of Positive Dispositions**   * Confidence * Flexibility * Initiative * Risk | Students share and explore their design ideas with their peers. Exploring a range of design ideas leads students to be flexible in their decision-making and open to feedback from their peers. Students will be confident to explore the topic of app design and data analysis due to their previous experiences with the topic. |
| **Critical Orientation**   * Interpreting Mathematical Results * Making Evidence-Based Judgements | Students are encouraged to use the findings from their analysis of the data set to justify their redesign of the app. They will listen to the suggestions of their peers and make judgments about their peers’ interpretations of the data set. At the conclusion of this lesson, students will critically evaluate the designs of their peers by voting for the most convincing and effective proposal. |

**References**

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Victoria State Government. (2020). *20-minute neighbourhoods.* <https://www.planning.vic.gov.au/policy-and-strategy/planning-for-melbourne/plan-melbourne/20-minute-neighbourhoods>

[Victorian Curriculum and Assessment Authority. (n.d.). Victorian Curriculum Foundation–10: Design and Technologies.](https://www.zotero.org/google-docs/?NwhFjo)

<https://victoriancurriculum.vcaa.vic.edu.au/technologies/design-and-technologies/curriculum/f-10#level=7-8>