Computerised Simulation of a Nutritional Food Label – is it CAD?

Abstract
This paper describes the use and application of a computer program that simulates the production of a nutritional food label. Aspects of Key Stage 4 requirements are met by using this simulation, which also links to the teaching of nutrition to students as well as the modification and reformulation of existing products. The question is posed as to whether this is CAD within the food industry and in food technology education.

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The author has been developing dietary analysis programs on mainframe computers for the use of dietetic students since the 1980s (Wise, 1986). He made an early excursion into programming for schools using the BBC computer (Lockie and Wise, 1987) but it is only with the development of Windows on the PC that highly sophisticated programs could be written that could be developed for students and then extended to other user groups. WinDiets is related to the program used to teach dietetic students and for research by the academic nutrition community. Its main focus was initially on the analysis of diets, but it has become clear that other nutritional issues should also be addressed and one of these is the food label. Dietitians and nutritionists working in industry are frequently involved in providing the data for food labels, and this situation can be used to provide a vehicle for an examination of the processes involved and particularly how products can be designed to be more healthy as reflected in the nutritional label.

It is now well-documented that students following design and technology courses in England and Wales at Key Stage 4 need to give due consideration to industrial practices in their coursework, including the use of computer aidied design (CAD). This is particularly true within the food technology suite of syllabuses, where there are a range of opportunities for students to apply ICT which simulates the way in which industry approaches new product development. The nutritional food label is one such example of a very appropriate simulation to use for teaching about how industry responds to advancing nutritional research by producing new recipes to meet consumer needs. It shows how the law protects the consumer by requiring labels to conform to strict guidelines that allow the consumer to compare foods. Since students are able to analyse labels on many foods within their own home, this simulation can be made relevant and easily accessible to them. Furthermore, when students are encouraged to carry out recipe modification and re-formulation, they can combine practical skills with the labelling simulation to achieve the desired information quickly and accurately using information and communications technology (ICT). A further enhancement of any simulation is the facility to produce a bar code, extending students' knowledge and understanding to that of control systems. Nutritional analysis and labelling software clearly addresses several of the Key Stage 4 requirements in National Curriculum 2000, which in turn will be translated into the new GCSE suite of syllabuses to be published later this year.

For example, under the new specifications students will be expected to use computer aided design to generate, develop, model and communicate design proposals (1g) and to use a range of industrial applications when working with familiar materials and processes (2b).

There is much good practice from students currently engaged in GCSE food technology to exemplify how they are using nutritional analysis and labelling software to enhance their coursework. But the question remains as to whether the use of such a computer program, to assist students' model recipe

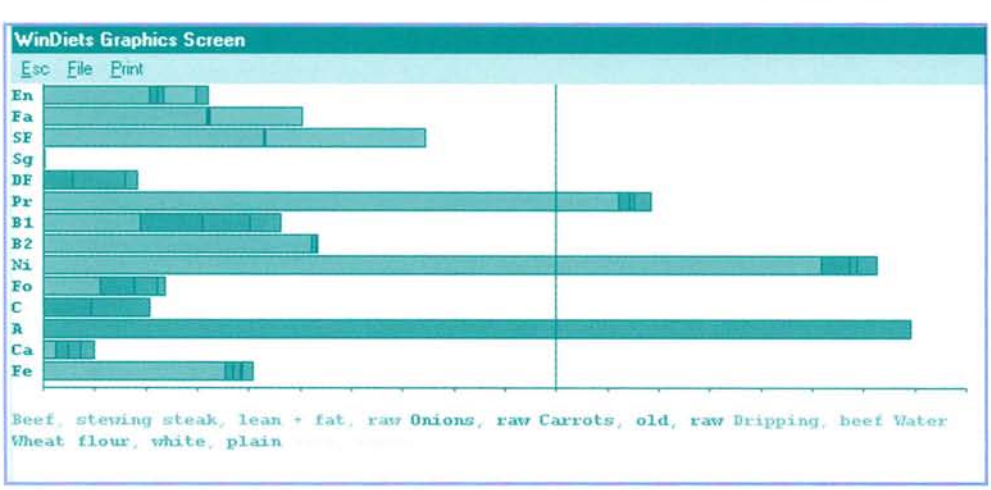

Figure 1: Illustration of how foods in a recipe are shown graphically.

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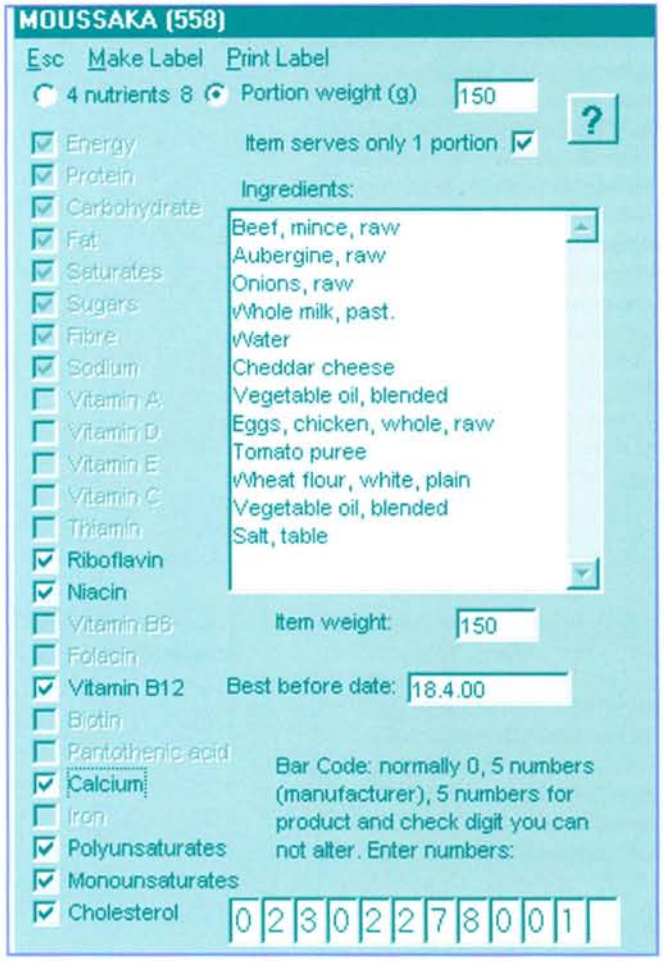

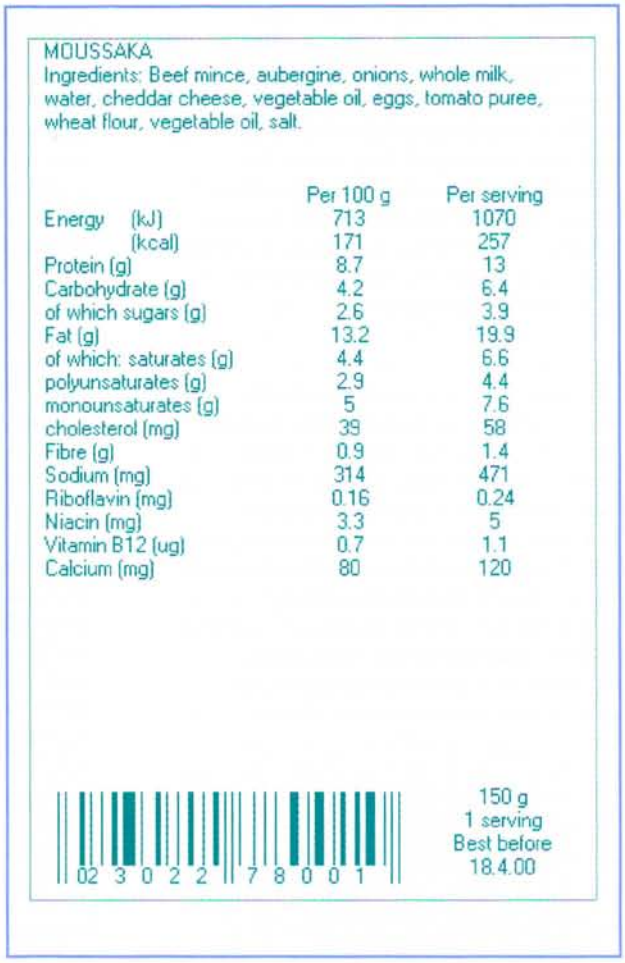

Figure 2: Screen that is used to select the format for the nutritional label.

Above right: Figure 3: The output screen for the nutritional label.

formulation, based on nutritional content is computer aided design in the broadest sense?

One such example is the use of WinDiets, a dietary teaching program designed with many features, one of which is the production of a food label. Students are provided with the recipes in the McCance and Widdowson food tables and can enter any others that are culturally more acceptable to represent foods that may be modified. Students can alter weights of foods and save the recipes in files of their own. A graph or tabulated analysis can be produced at any time during the process to show what foods provide each of the nutrients. The nutrients provided by each food in the recipe are shown in the graph as a different colour (see Figure 1). This gives students a clear indication of which foods to alter in the recipe to make it 'healthier'. There is a set of notes about the nutrients in the program and a list of the main nutritional messages that explain why they are being suggested to the public.

The UK Government through the Food Standards Agency, prescribes what must appear on a food label and what may appear. WinDiets attempts to produce the main characteristics of a label without total compliance to the law and therefore should not be used for a real product. The analysis of carbohydrates does not entirely comply because the McCance and Widdowson's food tables provide analysis in terms of monosaccharides so that starch appears to weigh more than it actually does due to having been expressed as glucose. In the label, carbohydrate must be expressed as actual weight, so monosaccharides would be the correct weight already, but disaccharides' weights need to be divided by 1.05 and starch by 1.1. Since the food tables do not distinguish between monosaccharides and disaccharides in the sugars field, the exact calculation cannot be made, but it is assumed that sugars are disaccharides for the simulation. Any carbohydrate not accounted for by starch and sugars is assumed to be oligosaccharide and the factor 1.08 has been used as recommended in the food tables. The data for protein in the label differs from that in the other output from WinDiets since the law states that it must be calculated by multiplying nitrogen by 6.25, whereas in the food tables, each food has a different factor.

The screen by default starts by assuming students only want the four nutrients specified by law, but this can be changed by specifying eight nutrients that are allowed, so it is therefore clear to the students what the law permits (see Figure 2). This is particularly helpful to differentiate between the needs of different learners. Advanced students might include polyunsaturates, monounsaturates and cholesterol, in which case the eight-nutrient format must be included. This happens automatically if students select even one of these extra nutrients. Micronutrients are only permitted when there is a minimum of at least 15% of the RDA in 100g of the food. If the portion size is greater than 100g and the appropriate box is checked, then the 15% rule recalculates and may permit more declarations to be made. Other nutrients will remain grey and cannot be included in the label. Students can also enter a 'best before' date if appropriate to make the label look more realistic. After making the label, students are able to edit the wording of the label that appears and then print it (see Figure 3).

Food production systems demand that packaging nearly always carries a bar code for use by manufacturers, retailers and consumers. This facility in WinDiets makes the product more realistic and helps to explain how a bar codes work. (Brain, 1998) The Print Screen key on the keyboard will copy the screen to the clipboard and students can learn to paste it into any graphics program, select a part of the image, and then copy and paste it into another program. This then allows students to incorporate the nutritional label as part of the rest of the packaging information that they are designing.

Bar codes have two sections: the machine-readable bar code and the human-readable 12-digit UPC number, which is not always shown in full. WinDiets shows only the inner 10 numbers. The first number is used to state what system is being used and is set to 0 in WinDiets, but if a student knows the system, they can alter it to the correct one. The following five digits are for the manufacturer and the next five digits are the item number. The Help file in WinDiets explains how the bar codes are calculated, so this simulation can be useful for understanding this principle that is used in most products in the supermarket. Students can enter different numbers and see how the bar code changes.

In an educational climate that demands rigorous use of ICT to assist teachers and their students to improve standards, nutritional analysis and labelling information is clearly a highly relevant application. This is clearly a type of CAD as the design of a new product is aided by the computer with regard to attempting to develop a healthier content and to designing a technically accurate lable. However, the computer does not actually determine whether the taste of the product will be acceptable. In a similar way, CAD used in the automotive industry can simulate technical capability and reliability, but cannot predict the consumer reaction to the aesthetics of a vehicle. However, the debate must surely begin as to whether this is computer aided design as applied to the food industry and food technology education?

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Left: Figure 4: Banchory Academy using WinDiets.