Food Safety training: A Model HACCP Instructional Technique

Georgakopoulos, Vassilis

10 December 2008

TOURISMOS: AN INTERNATIONAL MULTIDISCIPLINARY JOURNAL OF TOURISM
Volume 5, Number 1, Spring 2010, pp. 55-72

"FOOD SAFETY TRAINING: A MODEL HACCP INSTRUCTIONAL TECHNIQUE"

Vassilis Georgakopoulos
Food Safety & Quality Consultant - Trainer

This research project reports the findings of an original study with regards to a new ***Hazard Analysis Critical Control Point*** *(**HACCP**) instructional technique to be used for training purposes. The study investigated the effectiveness of a model HACCP instructional technique, the main characteristics of which are the adoption of a new methodology when teaching HACCP and the use of the emerging computer-based technology of* ***Virtual Reality*** *(**VR**). The findings highlight the advantages offered by the HACCP-VR instructional technique. This approach takes into account the environmental influences on food safety, thus, ensuring that* ***food safety training*** *is seen as part of an overall infrastructure for effective food safety control.*

Keywords: *HACCP, food safety training, virtual reality.*

INTRODUCTION

The *Hazard Analysis Critical Control Point* (HACCP) system is a food safety management system developed in the 1960s to ensure the safety of foods for the United States space programme. Since the 1960s HACCP has evolved into a recognized means to ensure the safety of foods throughout the food industry around the world. The application of the HACCP system is rapidly progressing; in particular in large and medium scale food industries, and more people than ever are being trained in food safety. At the same time, however, the incidence of foodborne diseases is increasing worldwide. Does this increase in foodborne diseases represent a failure of the way the system is being applied or even the system itself?

HACCP is a preventative system of food control. It was designed to control any area or point in the food production system that could contribute to a hazardous situation, whether from contaminants, pathogenic micro-organisms, raw materials, a process, consumer use directions, the distribution system, or storage conditions. The Hazard Analysis portion of HACCP was intended to identify sensitive ingredients and sensitive areas in the processing of ingredients or food where critical points must be monitored to assure product safety. From this information, the Critical Control Points (CCPs) in the system that had to be monitored could be determined. Critical Control Points (CCPs) are defined as those areas in the food production chain, from raw materials to finished product, where the loss of control could result in an unacceptable food safety risk.

Today, any HACCP system comprises of the following components:

(1) Identification and assessment of hazards associated with the growing, harvesting, processing-manufacturing, marketing, preparation, or use of a given raw material or food product

(2) Determination of critical control points at which identified hazards can be controlled

(3) Establishment of procedures to monitor critical control points

HACCP, therefore, is a preventative system in which safety is designed into the food formulation and the process by which it is produced. In practice it is a tool, but in principle it is a way of thinking. Therefore, it should come as no surprise that there could be different opinions on how it should be applied. Carrying out a hazard analysis and then implementing a system to control risks is impossible without relevant knowledge and expertise.

Food businesses are required to ensure that their staff is trained on the generalities and specifics of HACCP. As a result, training becomes the most important element in setting up a HACCP system. The reason for this is quite simple: only with an educated workforce can a manager run the lean and flexible organization demanded by today's competitive business environment. Modern training methods are designed to take workers to peak performance quickly and the company that invests both resources and commitment in training gains a competitive advantage. Education of food handlers in basic food safety is important so that rules are not seen as pointless irritants dreamed up by bureaucrats. If food handlers understand the reasons for the rules, this will encourage them to apply the rules rigorously and consistently.

HACCP is a form of 'change management' and this is also how learning is described. Learning is about change. The change brought about by developing a new skill, understanding a scientific law, changing an attitude. Learning is a relatively permanent change, brought about intentionally or by experience. HACCP is about changing attitudes with regard to food safety and Davies (in Reece and Walker, 1997) believes that attitudes cannot be changed before the appropriate change of behaviour. Attitudinal change often takes a long time but if participation is encouraged, then this slow process tends to be long term and to all intents and purposes permanent (Reece and Walker, 1997). Research (Rogers, 1989) into the ways people learn has identified that learning is generally more effective if it is based on experiences; either direct or experiences that have been read about. However, concepts that can be practiced or seen are more likely to be learned.

It emanates from the above discussion that studies on food safety training have failed to see HACCP training as part of an overall infrastructure for an effective food safety control system and this has led to the development of a *paradox in existing knowledge* and practices about HACCP (Motarjemi and Kaferstein, 1999). Consequently, this paradox forms our broad research question: "if more food handlers than ever are trained in food safety, why has the number of officially notified cases of food poisoning gone up at the same rate?" (Lachlan, 1998). The main problem facing food companies today, regarding HACCP training, arises from reliance on training designs which primarily emphasise the provision of information that rarely translates into positive attitudes and behaviours (Ehiri *et al*., 1997). To assist companies being competitive, training can take several forms. One of these is the use of *Virtual Reality (VR)* software.

Virtual Reality training allows for an interactive, simulated mode such that learners interface with the subject matter in a more meaningful and intensive way. According to an article in *Training and Development Journal* (Thierauf, 1995), "people retain about 25% of what they hear, 45% of what they see, and 70% of what they see, hear and do. The power of VR is that it keeps the learner seeing, hearing, and doing". Loeffler and Anderson (1994) define virtual reality as a three-dimensional, computer generated, simulated environment that is rendered in real time according to the behaviour of the user. VR systems provide the means for human beings to use their own sensory apparatus, a 'machine' that is incredibly flexible and agile, to manipulate and be manipulated by information and communication technologies. What is unique about VR and what it does do is to provide potentially more powerful means of creating the illusion of a real environment. Thus, it becomes apparent one important aspect of virtual reality: ***immersion***, or the degree to which the user's senses are limited to the simulation and screened from the real world. In computerised environments, the degree of immersion can vary significantly (Loeffler and Anderson, 1994). Another aspect of virtual reality is ***interactivity*,** which can take several forms and may include navigating within the virtual environment, turning features on and off, and interacting with other users. Many installations allow the user to interact with agents, which are computer-simulated characters that inhabit the virtual environment. It becomes evident therefore, that, virtual reality environments vary widely in crucial aspects because there is a great deal of difference between immersive and nonimmersive, interactive and noninteractive experiences.

The primary aim of this research was to intervene in the area of food safety/HACCP training via a new application of a methodology incorporating innovative aspects. In detail, the project was aimed at:

➢ *Developing and evaluating the effectiveness of a new methodology to be used when teaching and learning about HACCP.* The main features of the proposed methodology are: (a) the integration of food hygiene and HACCP concepts in a single food safety module and (b) a combination of student activities supported by the use of computers

➢ *Designing, developing, and evaluating the effectiveness of a model computer instructional software [based on Virtual Reality (VR) applications]* used to supplement the proposed methodology (the HACCP-VR educational software)

METHODOLOGY & DATA

Design and Development of the Educational Software

Having identified poor training as the source of the paradox in existing knowledge on HACCP, the next step was to design and develop the intervention (educational software based on virtual reality applications) to be used for HACCP training. The information presented in the text consisted of chapters on food hygiene, food microbiology and HACCP; all combined in a case study titled *"HACCP as applied in domestic kitchens"*. The task was to present HACCP as a way of thinking rather than a set of rules to be followed (new teaching methodology).

The main reasons for the choice of this topic (i.e. domestic kitchens) for a case study were:

➢ To show that food hygiene and HACCP can be combined in a single module, thus rejecting the methodology followed by training organisations

➢ To show how HACCP can be applied by the consumers in their everyday life

- To present all this information on the Internet, thus hoping to educate a large number of consumers all around the world and contribute in the reduction of food poisoning cases at home

In addition, it was decided to develop a simple type of VR system; a desktop VR system that allows the user to interact with a number of VR technologies on a personal computer (PC). Based on the same constraints, it was decided to:

- Develop a pilot software (examine a HACCP case study) and not a complete training course
- Use a range of VR technologies (video panoramic, virtual reality objects, interactive task and quiz, photographs of a working environment) and evaluate which one the trainees preferred
- Use the results of this evaluation for future developments in HACCP-VR

Within each section of the software, the trainee is able to use the computer mouse to explore more information and virtual environments.

Evaluation of the Educational Software

Subjects

Participants for data collection were full-time, first year students studying (at the Department of Food and Consumer Technology of the Manchester Metropolitan University) for one of the following degrees: (a) BSc (Hons) and HND Food Technology, (b) BSc (Hons) and HND Food and Nutrition and (c) BSc (Hons) Food Technology Management. The students hadn't received any training on HACCP before this study; however, during their time at the University they had been aware of basic food hygiene practices and the existence of food poisoning microorganisms. The students were first, randomly, divided into two groups: the **Intervention** (or United) and the **Control** (or City). These group names were chosen in an attempt to minimise students' awareness of the differences in the tasks involved and, thus, minimise bias.

Furthermore, a random division was ensured by, first creating an alphabetical list with the names of all the students involved in the study and then placing the names, alternatively, in each group list. From a total number of 56 full-time students approached and invited to participate in the study, a total of 42 (n=42) agreed to participate (male=14. Female=28), for a response rate of 75%.

Materials

To collect the data needed to assess the effectiveness of the HACCP-VR educational software, a four-week evaluation scheme was designed and the effectiveness was investigated by means of:

- A pre and post course questionnaire survey of the Intervention and the Control groups
- A quiz
- A qualitative evaluation questionnaire (only for the Intervention group)
- An observation session (based on a checklist) of a sample of students (7 students from each group)

<u>Week 1</u>: The author administered a pre-course questionnaire, to both groups and at the same time. Construction of the questionnaire followed a systematic review of the literature and an evaluation of the objectives of the intervention methodology and course. The questionnaire was pilot tested with a small group of second year BSc (Hons) Food Technology students prior to this session.

The questionnaire consisted of 20 multiple choice questions, divided into 5 sections, designed to test before the intervention course (treatment) participants' knowledge of, attitudes to, and opinions about:

- Awareness about germs (Section A)
- Food storage, cross-contamination and temperature control (Section B)
- Personal hygiene principles and practices (Section C)
- Knowledge of high-risk foods (Section D)
- Awareness about the HACCP system (Section E)

The participants were given 15min to answer all the questions.

<u>Week 2</u>: One week after the administration of the pre-course questionnaire, the participants, were divided into the Intervention and Control groups and were asked to perform the following tasks (based on the case study):

- The Control group was given, and asked to read, the text form of the educational software for 25min and, immediately after, answer a short quiz of 10 multiple-choice questions in 5min. The text form contained no pictures or drawings so that a better understanding of the impact of the intervention could be drawn. The quiz was designed to assess their knowledge and had been pilot tested with academic members of staff.
- The Intervention group was asked to interact with the educational software (HACCP-VR) for 25min, answer (immediately after) the same quiz as the Control group in 5min and, also, answer a

qualitative evaluation questionnaire (the trainees opinions about the software) 5min after the end of the session.

The HACCP plan of the case study was given to the students (to both groups) to take away with them, in the form of a handout. Both sessions took place at the same time in different classrooms at the Department of Food and Consumer Technology and were administered, in an attempt to minimise bias, by other members of staff than the author. The author was an observer of the session involving the Intervention group.

Week 3: This session took place 1 week after the course took place and the author administered a post-course questionnaire to both groups, at the same time. This questionnaire was identical to the pre-course. The session lasted for 15min and its purpose was to examine if the participants had increased (since the pre-course questionnaire) their knowledge on food safety as a result of the treatment.

Week 4: One week after the administration of the post-course questionnaire, 7 students (chosen randomly) from each group, were invited to participate in an observation session (observation in a real life situation). The students were, further mixed and divided into 5 groups (4 groups of 3 and 1 group of 2 participants) and 5 observation sessions were performed (lasting for 60min each) at the working environment presented in the educational software (i.e. the kitchen units of the University). Only 14 (out of 42) students were invited to participate in these sessions because of the high input in resources and time needed to run them.

During these sessions the participants were given a recipe to make ice cream and were asked to prepare it, as they would have done at home. No further instructions were given. At the same time, a member of staff (used in order to minimise bias) observed each student in his/her food safety practices. The observation was done by means of a checklist, designed by the author and pilot tested with a group of technicians. The author was an observer of each session. At the end of each session, students were given a handout containing the text form of the educational software, the recipe and the ice cream. The purpose of these sessions was to determine if any knowledge gained during the treatment had, not only been retained, but also transformed into correct food safety behaviour.

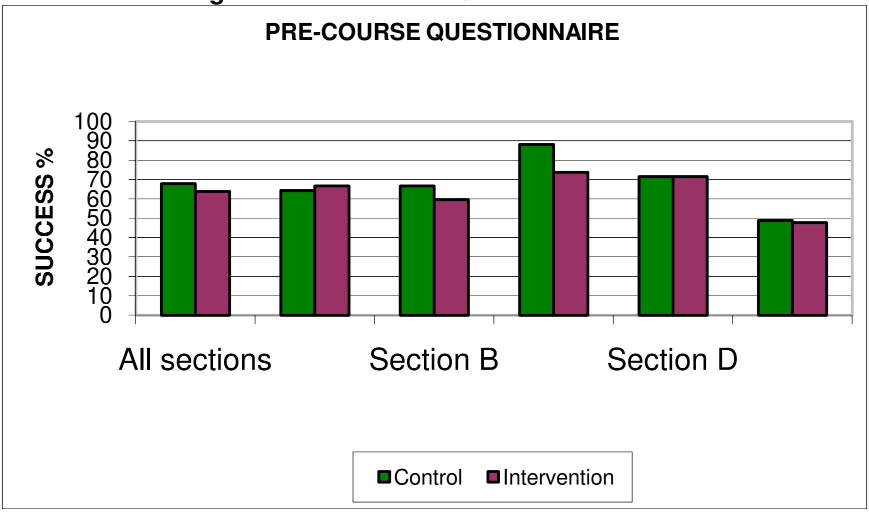
RESULTS & DISCUSSION

Pre-Course Questionnaire (Independent Samples T-Test)

Aim of this questionnaire was to assess trainees' entry behaviour to the course (i.e. intervention treatment). There were no significant differences in the pre-course scores for the individuals in the Intervention or Control groups, with the exception of section C scores. A more detailed examination of the scores obtained shows that:

- The Control group scored slightly better, overall, than the Intervention group (67.86% v 63.81%). The difference, however, is not significant
- The Control group scored significantly better (88.10% v 73.81% or **P<0.05**) in Section C (personal hygiene principles and practices). However, no assumptions can be made for this difference and identify exactly why it has occurred
- In the rest of the Sections, the results show no significant difference in food safety knowledge and behaviour between the two groups of the trainees

Figure 1. Pre-Course Questionnaire



Quiz (Independent Samples T-Test)

Aim of this quiz was to be used as a formative assessment to examine the level of knowledge gained by the trainees immediately after the treatment took place. Although there was no significant difference observed in the scores obtained by the two groups, it could be seen that both groups scored extremely high: 91.43% v 94.29%. It could be assumed, therefore, that the proposed methodology is effective. However, these scores, although high, cannot be taken as an indicator of a highly successful session.

Table 1. Quiz

Quiz	Groups (%)		T-Test	
	Control	Intervention	t-statistic	Significance
All Questions	91.43	94.29	-0.953	0.346

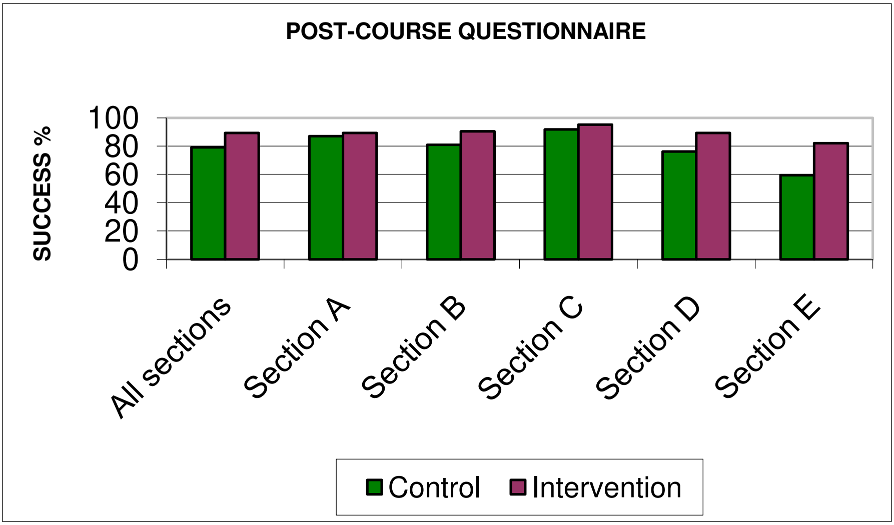
The results of the quiz highlight the false indications trainers might get (for the level of knowledge gained by the trainees) when they rely on such forms of assessment because these results relate to the short-term memory of the trainees, which in turn, relates to the factual information that is the basis of all subjects. It is not concerned with understanding but only with the *recall* of the factual information.

Post-Course Questionnaire (Independent Samples T-Test)

The results of the post-course questionnaire, which was administered 1 week after the intervention treatment, aimed at examining the level of knowledge gained by the trainees due to the intervention. The results show the following:

- The Intervention group has scored significantly better, overall, than the Control group (89.29% v 79.05% or **P<0.001**)
- The Intervention group has scored significantly better (82.14% v 59.52% or **P<0.001**) in Section E (awareness about the HACCP system)
- The Intervention group has scored better (**P<0.05**) in Sections B (food storage, cross-contamination and temperature control) and D (knowledge of high-risk foods)
- There were no significant differences observed in the scores of Sections A (awareness about germs) and C (personal hygiene principles and practices). The results for Section C, however, show that the significant difference observed in the pre-course questionnaire, in favour of the Control group has been diminished and slightly reversed in favour of the Intervention group.

Figure 2. Post-Course Questionnaire

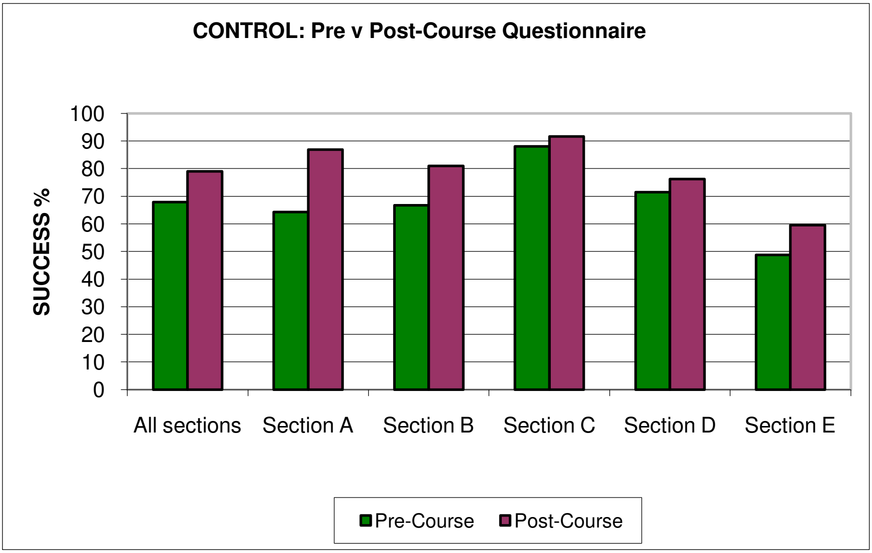


Control: Pre v Post-Course Questionnaire (Paired Samples T-Test)

In order to test the Control group's level of knowledge gained before and after the course, their scores before and after reading the text form of the case study have been analysed. The results show that:

- By reading the material presented, the trainees increased, overall, their knowledge significantly (67.86% v 79.05% or **P<0.01**)
- There was a significant difference (**P<0.01**) observed in the scores of Section A (awareness about germs)
- There was a significant difference (**P<0.05**) observed in the scores of Section B (food storage, cross-contamination and temperature control)
- There were no significant differences observed in the scores for Sections C (personal hygiene principles and practices), D (knowledge of high-risk foods), and E (awareness about the HACCP system)

Figure 3. Control: Pre v Post-Course Questionnaire



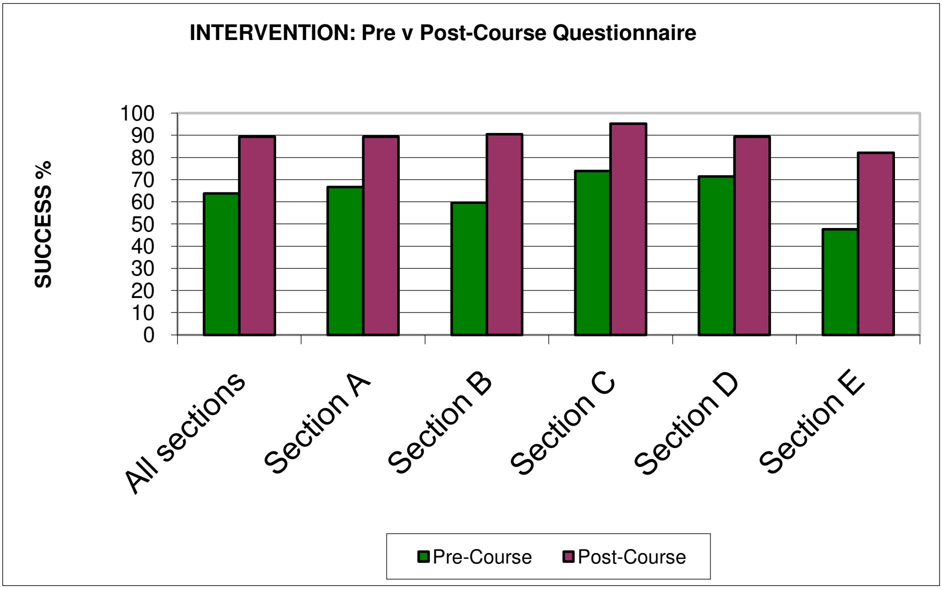
Intervention: Pre v Post-Course Questionnaire (Paired Samples T-Test)

In order to test the Intervention group's level of knowledge gained before and after the course their scores, before and after interacting with the new methodology and the educational software, have been analysed.

The individuals that interacted with the educational software were able to increase their overall knowledge significantly (**P<0.001**). The results, also, show that:

- The increase in knowledge was highly significant (**P<0.001**) for Sections A (awareness about germs), B (food storage, cross-contamination and temperature control) and E (awareness about the HACCP system)
- The increase in knowledge was significant (**P<0.01**) for Sections C (personal hygiene principles and practices) and D (knowledge of high-risk foods)

Figure 4. Intervention: Pre v Post-Course Questionnaire



Observations (Independent Samples T-Test)

The reason it was decided to, further, follow up a sub-group of students from each group and observe how they perceive food safety, was twofold. First, because it is believed that knowledge alone is insufficient to trigger preventive practices and, second, because some mechanism is necessary to motivate action and generate positive attitudes. Thus, having established that the model HACCP instructional technique has resulted in increase in knowledge, it was decided to test if the visual stimulation offered by virtual reality can result in motivating trainees and, therefore, generating positive attitudes towards food safety. This was achieved by observing how the trainees act (in terms of food safety) within their actual working environment. Would they be able to translate their knowledge into practice?

The results show that the trainees who interacted with the educational software, 2 weeks after the intervention:

- Have significantly (**P<0.001**) translated their knowledge into positive attitudes, compared with the Control group
- By reading, only, a text is not possible to grasp the notion of HACCP as a way of thinking

➢ It was decided not to, statistically, analyse each section of the checklist because: (a) the number of variables included is small, thus not providing for meaningful statistical analysis; (b) the checklist was divided into sections in order to familiarise the observers with the steps they had to assess; (c) it is believed that the sum of the points assessed rather than individual points should be examined in order to evaluate food safety practices

Table 2. Observation Checklist

Observation	**Groups (%)**		**T-Test**	
	Control	Intervention	t-statistic	Significance
Check List	71.43	84.76	-3.363	0.001***

(*** For $P<0.001$)

CONCLUSIONS

This original study has drawn significantly from the fields of food technology, business administration, education and information technology, in examining the following paradox in existing knowledge on HACCP: *"If more food handlers than ever are trained in food safety, why has the number of officially notified cases of food poisoning gone up at the same rate?"*

The combination of evaluation methods used (pre-, post-intervention questionnaires, quiz, and observations in real life situation) was another notable improvement of this study over previous evaluations of food safety training. The findings provide useful information to advance the debate on the effectiveness of HACCP/food safety training on offer:

➢ Given that the evaluation groups were drawn from a sample frame, which will provide future food handlers, their increase in knowledge provides an indication of the strengths of the proposed HACCP methodology

➢ In addition, the overall good performance of the Intervention group (on virtually all aspects of the evaluation process) provides an indication of the high potential of the HACCP-VR model HACCP instructional technique, which could be further developed and used for formal HACCP training.

It is believed that further development of the HACCP-VR could easily be achieved under different settings and employees of the food industries would be able to be trained effectively. The HACCP-VR educational software was designed and developed by the author, not an expert himself in information technology, in 15 months. The same project, however, can be developed by companies specializing in VR applications in as little as 2 months and, if funding is available, can include more advanced settings, interactions with the virtual environments and highly sophisticated assessment methods.

Advantages and Disadvantages of HACCP-VR Training

Virtual reality training can be especially useful for induction, product training, and other forms of information transfer where the quality of visual image and a pre-determined learning process are important factors.

The main ***advantages*** of the proposed instructional technique are that:

- It can offer a *'tailor-made' HACCP training course* the content of which is drawn directly from the actual working environment of the company in focus, thus taking into consideration how adults prefer to be taught (i.e. by using their experiences as a source of learning)
- It presents HACCP as a preventative way of thinking rather than a set of rules to be followed, thus contributing to a better understanding of the concept by the trainees
- It results in a highly motivating experience for the learners

The ***benefits*** of an on-line HACCP training course, it is believed, depend on initial investment and clear organisational targets, set by the company. As a result:

1. Learning could become more directly relevant to the workplace, possibly leading to improved business results
2. Increased collaboration between learning teams may be improved
3. It is possible that a company may benefit financially as a result of less total time spent away from the job by the staff, less travelling costs and increased reusability of the training materials
4. The training material could easily be available to new staff immediately
5. The training could be consistent and significant contribution to learning management could be achieved through the development of best practice in relation to each area of learning
6. The training material could easily be available at a time and duration to suit the company therefore being more flexible (modular

design) and more learner-centred, which leads to trainees taking more responsibility for their own development

7. Learning and improvement through clear assessment and feedback could be tracked with increased support for learning and implementation

8. Learning could be used where the real situation is dangerous, costly, 'difficult' or too time consuming; could be repeated until desired level is achieved; and, could be stopped at any stage in order to inject concepts, principles etc.

The ***disadvantages*** of the method, as they were experienced during development, implementation and evaluation, relate to the following:

- It can be time consuming to set up
- It may be difficult to supervise all trainees at the same time
- High expertise is needed in order to produce advanced computer applications
- It was difficult to persuade people to, voluntarily, participate in the research (computer phobia?)
- Problems with the computer network resulted in frustration by both the trainer and the trainees
- A basic level of computer knowledge is necessary, in order for the trainee to navigate himself/herself through all areas of the virtual environments
- The initial cost of investment by food companies, in external expertise and software/hardware necessary to run the computer applications, can be high

In order to overcome these problems, it is believed that is necessary for the food company to take part in the design and development of the educational software, use small numbers of trainees for each training session and invest on an affordable number of reliable PCs (start-up investment). In addition, it should be made sure that the software is as user-friendly as possible in order to accommodate trainees who feel uncomfortable when in front of a computer.

Research implications

The intervention of this study in the area of food safety/HACCP training has been:

- The development of a new HACCP methodology
- The creation and evaluation of a HACCP-VR educational software pilot package

It has been advocated that an educationally successful approach is instruction led. A specific teaching and learning situation (food safety/HACCP training) has been selected; the main limitations in the current delivery methods (low trainee participation, low motivation, lecture-based teaching, no correlation with trainee's working environment) have been identified; a solution (the new, computer-based, HACCP methodology) has been designed, applied and evaluated.

It was shown that this intervention could provide the basis for a highly participative as well as motivating activity for structured, individualised learning as the technology enables the user to enter and participate in new realities that were not available in the past.

However, although the choice of the domestic kitchen scenario provided some flexibility in the development of a generic software package, this is not going to be the case when designing a training package for the food industries. Such a software package that will be used by a food company, because of its VR nature, must be 'tailor-made' to the needs of the company's trainees and should be based on the company's HACCP plan.

In addition, the pre-requisites for the trainees (as in the case scenario) will be basic computer skills, access to computers and competency in the English language (different language versions might be necessary). Also, a more advanced software will be necessary to capture all aspects of a factory-based scenario because of the complexity of operations involved.

The effectiveness of such HACCP training courses should be evaluated through audit of the CCPs and long-term course effectiveness should be reflected in changing trends in reported foodborne disease outbreaks.

From the standpoint of newly hired employees, they could learn about their jobs by using VR applications. This way of learning how their jobs are to be performed efficiently and effectively is faster and better than videotape or traditional training methods (Thierauf, 1995). It also adds more interest to the daily routine. In fact, as Thierauf (1995) adds, in the USA, to train a large number of production workers in government-required health and safety measures, some companies have installed interactive video workstations in their plants. During lulls in production, employees can interact with 30 to 45 minutes of self-paced training. The net result is that many dollars are saved in training costs.

Aim of this study, however, is not to try and implement everything on computers because the best solutions are often characterised by computer mediated education that is not carrying the main exposition, and is not the centre of attention (Draper, 1998). By presenting this model computer-based instructional technique for HACCP training it is not being adopted the use of computers only for training because, as Saunders (1998) states, it is the organisational culture and environment, which ultimately shapes the learning experience rather than the technology itself. In addition, it is believed that no single training delivery technique is a panacea for new and inexperienced trainees.

The best solution, in the author's opinion (Georgakopoulos, 2003), is a training programme that combines on-the-job training, tutorials, short/introductory lectures, workshops, and Virtual Reality applications. Such a programme must be designed to achieve both individualized and company goals; a training programme that utilises a variety of instructional techniques which, as Kolb (1984) has shown, is very important for effective learning. It should not be forgotten that any training programme must, also, fit the company's objectives, budget and staff/user ratio. However, if the responsibility for learning is placed with individuals then time and resources at work must be made available.

In conclusion, whatever the technique (or techniques) selected, food safety training is a key strategic investment for keeping a food company competitive and only by teaming up with today's advanced training technologies can food safety trainers meet the challenges of tomorrow's business environment.

REFERENCES

Draper, S.W. (1998). Niche-based success in CAL. Computers & Education, Vol. 30, No.1/2, pp.5-8.

Ehiri, J.E., Morris, G.P. & McEwen, J. (1997). Evaluation of a food hygiene training course in Scotland. *Food Control*, Vol. 8**,** No.3, pp.137-147.

Georgakopoulos, V. (2003). Managing food safety: How well trained is your kitchen staff? *Paper presented at the Tempus International Scientific Conference*. Ohrid, FYROM: 10-12 October 2003.

Kolb, D.A. (1984). *Experiential Learning - Experience as a Source of Learning and Development*. UK, Prentice Hall.

Lachlan, H. (1998). Food poisoning cases are on the increase. *Environmental Health News*, Vol. 13, No.44, pp.7.

Loeffler, C.E. & Anderson, T. (Eds.). (1994). *The Virtual Reality Casebook*. USA, Van Nostrand Reinhold.

Motarjemi, Y. & Kaferstein, F. (1999). Food safety, hazard analysis and critical control point and the increase in foodborne diseases: a paradox? *Food Control*, Vol. 10, No.4-5, pp.325-333.

Reece, I. & Walker, S. (1997). *Teaching, Training and Learning. A Practical Guide*. Great Britain, Business Education Publishers Limited.

Rogers, A. (1989). *Teaching Adults*. UK, Open University Press.
Saunders, M. (1998). Organisational culture: electronic support for occupational learning. *Journal of Computer Assisted Learning*, Vol. 14, No.3, pp.170-182.
Thierauf, R.J. (1995). *Virtual Reality Systems for Business*. USA, Quorum Books.

SUBMITTED: DECEMBER 2008
REVISION SUBMITTED: MARCH 2009
2nd REVISION SUBMITTED MAY 2009
ACCEPTED: JUNE 2009
REFEREED ANONYMOUSLY

Vassilis Georgakopoulos (vgeorgakopoulos@hotmail.com) BSc, MBA, PGCE, PhD, MSOFHT, MIFST, Food Safety & Quality Consultant – Trainer, 10 Miniati str., Athens, 11636, (Greece).