ICT for food safety education: a case study of an Erasmus+ Jean Monnet Module on EU food safety control

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Abstract

The European Union (EU) has established a comprehensive system of food safety assurance and official food control to protect the health of consumers and animals, as well as the environment. However, the understanding and implementation of this system may vary across different countries and regions, especially in the context of the COVID-19 pandemic. In this paper, we present the design, development and evaluation of a new training module on EU Food Safety Control at the Department of Veterinary Hygiene of NULES, Ukraine. The module aims to provide students and professionals with the knowledge and skills to apply the EU food safety standards and regulations in their own contexts. The module uses information and communication technologies (ICT) to deliver blended and distance learning modes, depending on the situation. We describe the ICT tools and methods used for the module, such as online platforms, interactive quizzes, webinars, podcasts, videos and e-books. We also report the results of a pre- and post-test assessment of the participants' knowledge on EU food safety control, as well as their feedback and satisfaction with the module. We use the impact effort matrix technique to analyze the effectiveness and efficiency of the ICT actions taken for achieving the project outcomes. The results show that the module has improved the participants' knowledge and awareness of EU food safety control, and that they have appreciated the flexibility and diversity of the ICT tools used for the module. We discuss the challenges and opportunities of using ICT for food safety education in Ukraine and beyond.

Keywords

food safety, EU, ICT, education, Erasmus+

1. Introduction

Digital technology has become an essential part of teaching and learning in the 21st century, especially in the context of the COVID-19 pandemic that disrupted the traditional modes of education [1, 2, 3, 4, 5, 6, 7, 8]. The European Digital Education Action Plan [9, 10] identifies

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three priorities for enhancing digital education in the European Union (EU) and beyond: making better use of digital technology for teaching and learning, developing digital competencies and skills, and improving digital education through data analysis and foresight. These priorities are aligned with the strategy for the development of education in the EU and other countries that has been focused on the introduction and integration of information and communication technologies (ICT) in the curricula and pedagogy [10, 11, 12, 13]. ICT can facilitate innovative and flexible learning approaches, such as blended and distance learning, that can cater to the diverse needs and preferences of learners [14, 15, 16, 17, 18, 19, 20, 21, 22]. However, ICT also poses some challenges and opportunities for educators and learners, such as the availability and accessibility of digital resources, the quality and relevance of digital content, the development and assessment of digital literacy, and the ethical and social implications of digital education [23, 24]. Therefore, it is important to evaluate the effectiveness and efficiency of ICT for teaching and learning in different contexts and domains.

One of the domains that requires ICT for teaching and learning is food safety, which is a multidisciplinary field that involves the protection of human and animal health, as well as the environment, from food-borne hazards. Food safety is a key issue for the EU, which has established a comprehensive system of food safety assurance and official food control to ensure high standards of quality and safety for food products within its borders and beyond [25]. However, the understanding and implementation of this system may vary across different countries and regions, especially those that are not part of the EU but have close trade relations with it. For example, Ukraine is a strategic partner of the EU in terms of agricultural produce, but it faces some gaps and challenges in aligning its food safety policies and practices with the EU requirements [26]. Therefore, it is essential to provide adequate education and training for future food safety experts in Ukraine who can apply the EU food safety standards and regulations in their own contexts.

In this paper, we present a case study of an Erasmus+ Jean Monnet Module on EU Food Safety Control that was developed and implemented at the Department of Veterinary Hygiene of NULES, Ukraine. The module aims to provide students and professionals with the knowledge and skills to understand and apply the EU food safety system in their own contexts. The module uses ICT to deliver blended and distance learning modes, depending on the situation. We describe the ICT tools and methods used for the module, such as online platforms, interactive quizzes, webinars, podcasts, videos and e-books. We also report the results of a pre- and post-test assessment of the participants' knowledge on EU food safety control, as well as their feedback and satisfaction with the module. We use the impact effort matrix technique to analyze the effectiveness and efficiency of the ICT actions taken for achieving the project outcomes. The results show that the module has improved the participants' knowledge and awareness of EU food safety control, and that they have appreciated the flexibility and diversity of the ICT tools used for the module. We discuss the challenges and opportunities of using ICT for food safety education in Ukraine and beyond.

Objectives of the research were to assess outcomes of the project and value the role of ICT in achieving the project results:

- The effect of teaching activities on participants' knowledge improvement;
- The dissemination effect of open events on participants' awareness raising;

- The overall assessment of relevant project outputs by action priority matrix, judged on the basis of strategy for the dissemination and exploitation of project results for Jean Monnet projects [27].

2. Theoretical background

Erasmus+ Jean Monnet Activities are one of European grant supported programs intended to promote the benefits of European integration and development of cooperation, dissemination of European studies in Europe and other continents. The initiative of the grant conditions of the program belongs to the Council of European Universities and teachers from all over the world who conduct research in the field of European integration [28]. Grant funds are earmarked and allocated to universities to start in the educational process of teaching disciplines that are directly related to the development of European law, European economy, education, science, culture, history, theory and practice of European integration. The content of the Jean Monnet European Education Module under the terms of the grant project was to develop and teach specially designed short-term courses on European integration for a certain category of students. Figure 1 describes how the general objectives of the Jean Monnet Erasmus+ Programme are addressed in the module activities and ICT integration in the project "EU Food Safety Control" (587548-EPP-1-2017-1-EN-EPPJMO-MODULE).

A new training module on EU Food Safety Control was developed and implemented at the Department of Veterinary and Sanitary Examination (currently Department of Veterinary Hygiene) of National University of Life and Environmental Sciences of Ukraine (NULES). The

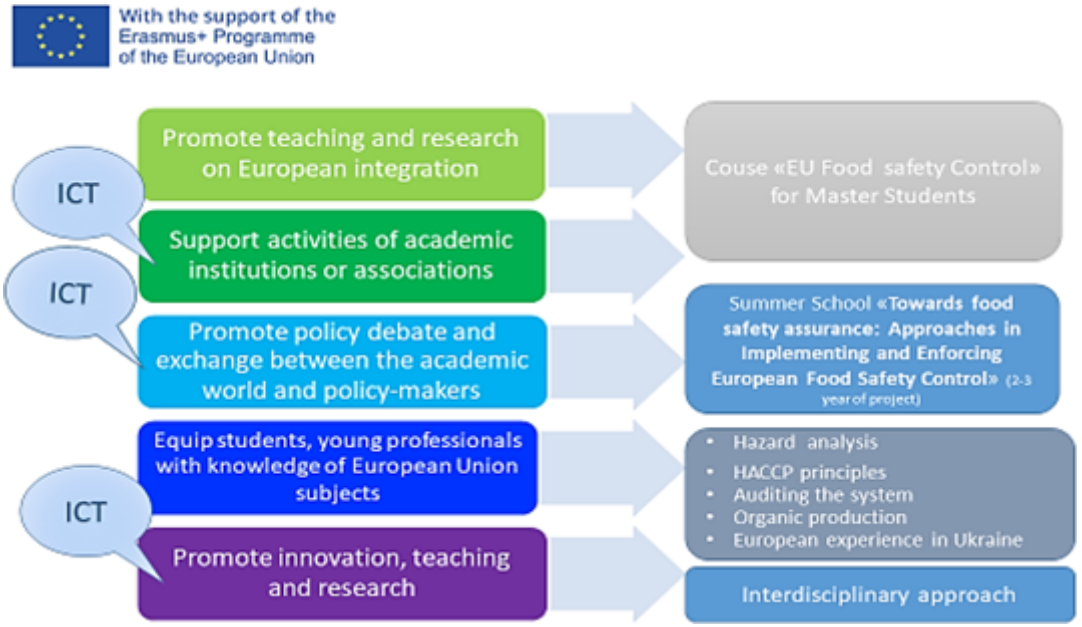

Figure 1: Consistency between programme objectives and design of Jean Monnet Module "EU Food Safety Control".

course addressed key elements of European food law, including the EU's strategy for food and feed safety assurance and the processes of food safety policy integration. The module include fundamental questions – theoretical background of food safety based on risk analyses and practical application of procedures for official controls in the food processing chain.

There were three cohorts of participants:

1) students of the fifth term of the Faculty of Veterinary Medicine with similar educational background;
2) participants of the open events;
3) principal participants of the project (authors of the project and other experts involved in project management).

Main research questions of the study aimed:

1. To assess the effect of ICT introduction in the "EU Food Safety Control" module on knowledge and skills development of the students.
2. To assess dissemination effect and impact the ICT make to the open event success.
3. Value the ICT role in achieving project results from the point of management and implementation.

3. Study design

3.1. Target groups, activities and ICT involvement

The main target group of the module educational activities (first cohort) was Master's students of the Faculty of Veterinary Medicine studied the training course "EU Food Safety Control" (figure 2).

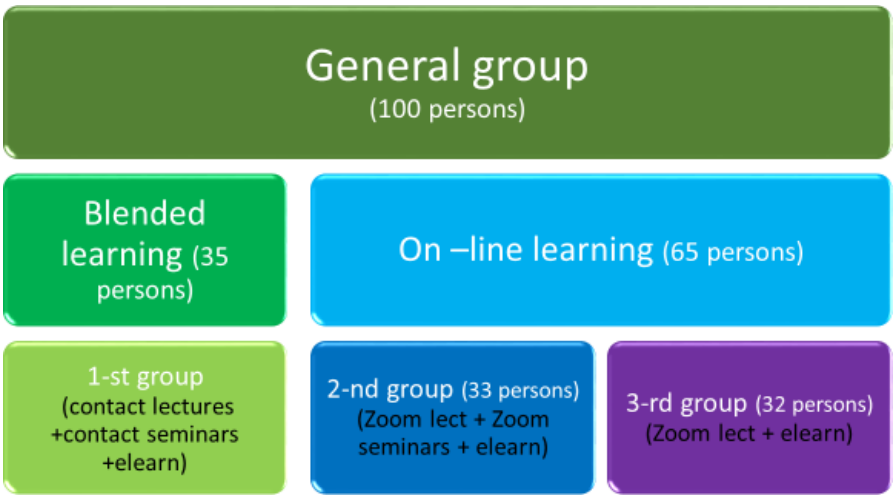

Figure 2: Organization of the educational process and different conditions of the course delivery.

For evaluation of university course efficiency and the role of ICT in teaching activities, data of the students testing were analyzed as a general cohort and with regard to different conditions

of the course delivery. For that purpose participants were divided in three groups: 1-st group studied the course as blended learning (with both contact lectures and seminars supported by the course on e-learning platform); 2-nd group studied the course with both lectures and seminars delivered with Zoom and supported by the e-learning course; 3-rd one had only Zoom lectures but seminars were provided only with e-learning platform.

Open activities, like summer school and round tables, were targeted to students and participants from outside the department meaning that, all interested stakeholders who specialize in related issues were invited to take part in. That was the second cohort of involved participants, that included students and researchers, practicing veterinarians, representatives of the State Service of Food Safety and Consumer Protection (SSFSCP), NGOs and other EU projects in Ukraine.

Principal participants responsible for the project management and implementation (third cohort of participants) were involved in assessment of project management efficiency by the project outcome.

The readiness for the introduction of digital technologies in the educational process and project activities was studied in NULES of Ukraine for designing the project implementation plan with the maximum involvement of digital technologies [29]. As a result, the digital educational environment of NULES of Ukraine (https://nubip.edu.ua/en/node/3033) has the necessary resources for the effective implementation of the project.

The preparation stage comprised of developing the content of the web page to be hosted within the university website (https://nubip.edu.ua/node/72229) and FoodSaCo site development (http://greeneconomy.com.ua).

An e-learning training course "EU Food safety Control" [30] covers the actual issues of organization of food safety assurance system of the European Union and its legislation on the food safety. The course was developed by the FoodSaCo team and became one of the modules of the courses "State Veterinary and Sanitary Control" for Master's students in Veterinary Hygiene, Sanitary and Expertise (VHSE), "State Veterinary and Sanitary Expertise" for Master's students in Veterinary Medicine (VM), and university elective course "EU Food Safety Control". According to the plan, the project educational activities, started in September 2017, included delivery of the educational course to the Master Students of Veterinary Hygiene, Sanitary and Expertise and Veterinary Medicine.

The Summer Schools "Towards food safety assurance: Approaches in Implementing and Enforcing European Food Safety Control" with round table debate "EU – Ukraine interaction for the food safety assurance" was planed for the second (2019) and third (2020) year of the project as open event for Ukrainian competent authorities and food business operators, State Service of Ukraine for Food Safety and Consumer Protection (SSFSCP) inspectors, practical veterinarians, higher school lecturers and researchers, the public in order to disseminate project results.

First Summer Schools with round table debates implemented one on May 14–16, 2019 on the basis of the state institution Scientific and Methodological Center for Information and Analytical Support of Higher Education Institutions "Agroosvita" with 50 registered participants, involving teachers of vocational education institutions, representatives of the SSFSCP, NGOs and other EU projects in Ukraine.

Taking into account special measures at the national and University level caused by COVID-19 outbreak, open school 2020 was implemented via Cisco (Webex Event) platform and resulted

in better dissemination due to attraction more than 180 participants.

Digital resources that were used in project implementation could be divided in following categories [31]:

1. Didactic components used to support learning inside the course and project events.
2. Communication tools (emailing, messaging, web conferencing).
3. Learning Management System (on-line course delivery).

Two first years of the project implementation involved digital and ICT tools only as didactic and supportive. The e-learning course was developed in accordance with the "Regulations on Organization of Academic Process in NULES" and was not declared in approved project application. Due to presence and sufficient development of university digital learning environment (DLEs) our project continued to implement the program of action with certain flexibility despite special measures taken at the national and the university level caused by COVID-19 outbreak. The teaching activities for MSc students in spring 2020 were delivered on-line with Zoom lectures but seminars were delivered only by the distant learning course on the university e-learning platform [30]. Students of Veterinary Medicine in 2019 had blended learning (contact lectures and seminars supported by the course on e-learning platform), and in autumn 2020 studied on-line with both lectures and seminars provided in Zoom, with the support of the university e-learning platform.

Previously planned Spring school 2020 "Towards food safety assurance: Approaches in Implementing and Enforcing European Food safety control" was implemented in Cisco (Webex Event) platform and resulted in better dissemination due to attraction more than 180 participants.

3.2. Methods and study materials

To discover the first research question students' knowledge on food safety control was assessed prior to the delivery of the educational Module curriculum using a pretest that included true/false and multiple-choice questions. The participants completed the same food safety control knowledge assessments (posttest) immediately after course completion via an online test on the university e-learn platform [30]. The homogeneity of entry tests results were the basic to consider the groups as homogenous. Collected data were initially summarized in Microsoft Excel and analyzed with Students' t-distribution.

The second research question dealt with the second cohort of participants. Open event held on-line (in 2020) resulted in involvement of 30 students and 150 researchers, representatives of the SSFSCP, NGOs and other EU projects in Ukraine – 180 persons total. For open summer school activity a short questioner was developed on the attitude and impression about distance learning activities and events (http://surl.li/pqyf). The participants were asked about general impressions of the event, their attitude to events (conferences, etc.) held on-line and the effectiveness of that kind of activities. The questions of the study also considered the participants' perception of distance learning vs. full-time, and a) main benefits and b) main disadvantages of distance learning.

Project team (third cohort), including 12 participants in total from the Faculty of Veterinary Medicine, Faculty of Information Technologies, International Relation Office, university financial department and Erasmus+ Office of Ukraine conducted the assessment of ICT for the project

management success. Impact effort matrix technique was used for determining the best action taken for achieving project result. The criteria for assessment project results were developed in accordance with Erasmus+ working documents [32, 33]. The impact of each project outcomes and effort involved were scored from 0 to 10. By creating a matrix with four quadrants and plotting the results based on the effort required to implement (x-axis) and the impact (y-axis), the outcomes falling into the upper left-hand quadrant are the best action taken.

4. Main findings

4.1. Evaluation of university course efficiency

Participants' food safety control knowledge was evaluated with a questionnaire before and after the module. The results of pre- and post-tests are provided in table 1.

The questionnaire included questions about different aspects of food safety assurance. Only 3 out of 100 participants had grades lower than 60% and 9 had minor (i.e. = 60%) food safety knowledge in the pretest. After the delivery of module, students demonstrated certain progress in knowledge. The progress in case of blended learning, when students had contact lectures and seminars additionally supported with e-learning platform (1st group), was considerably higher than in case of on-line study in general, but when lectures and seminars were provided through Zoom (2nd group) students demonstrated the slightly lower post-test results. Nevertheless, the study indicates that Zoom seminars in the condition of on-line study could be considered as effective as contact lessons. Students of 3rd group, who did not have Zoom seminars, demonstrated the minimal progress, although they had the highest pretest results. The latter corresponds with findings of Mok et al. [34] that the students with lower initial grade improves at a faster rate than those who started at a higher level.

Table 1
Analysis of the success rate of training participants by method of communication during educational process.

Group of students	Pre-assessment test rate	Final test rate	Progress	
			rate	%
General cohort	21.31±0.47	24.65±0.44	3.33	15.64
% to maximum grade	71.04±1.55	82.15±1.47	11.11	
1st (contact lectures and seminars + LMS Moodle courses)	21.38±1.13	28.65±0.47	5.46	25.54
% to maximum	71.28±3.03	89.49±1.39	18.21	
On-line (general)	20.83±0.52	23.93±0.55	3.10	14.88
% to maximum grade	69.44±1.73	79.78±1.90	10.33	
2nd (Zoom lectures and seminars + LMS Moodle courses)	20.12±0.37	24.88±0.64	4.76	23.68
% to maximum grade	67.06±1.46	82.94±2.13	15.88	
3rd (Zoom lectures + LMS Moodle courses)	21.77±0.77	22.69±0.74	0.92	4.24
% to maximum grade	72.56±2.55	75.64±2.47	3.08	

4.2. Open school activities application and evaluation

The main purpose of open events were to disseminate the results of the project by sharing practices, knowledge and experience gained during the project. Comparison of the number of participants and organizations involved in contact and on-line open event indicated the better dissemination effect of the on-line meeting.

Participants of on-line event were offered to take part in survey about their impression and attitude to the event and to distance learning (http://surl.li/pqyf). All participants had good impression about the event emphasizing on high quality of organization and content. About the efficiency of on-line events (conferences, etc.): 64.5% of respondents reacted positively, indicating that it is an opportunity to join the discussion of topical issues and save money and time; 20.7% indicated that the form of communication does not matter if the topic is interesting and experts are experienced; 10.7% of participants considered the on-line communication only in case of force majeure (for example, quarantine); and only 4.1% reacted negative, assuming the face-to-face events are more effective.

The idea of distance learning was clearly supported by 9.9% of respondents; 36.4% preferred blended learning; 38.8% considered that the form of learning is not essential if a person is motivated to learn; 10.7% believe face-to-face training is always more effective; 4.1% emphasized the need of support from administration.

As main disadvantages of distance learning participants considered technical failures, lack of contact with audience and between participants.

4.3. Project results impact vs effort evaluation

The evaluation of taken efficiency actions for achieving project outputs or outcomes that are relevant for project results [27] reviled that most effective of them involve ICT (marked blue) (figure 3).

Most of the activities with ICT technologies required certain effort or better preparedness and skills from the team involved in project implementation.

5. Conclusions

The main goal of this project was to teach and disseminate the key aspects of the EU food safety assurance system, and to contribute to the reflection and debate about the food safety official control challenges of Ukraine. The project used ICT to support the teaching and learning activities, as well as the dissemination and exploitation of the project results, in the context of the COVID-19 pandemic that affected the traditional modes of education.

The project developed a methodical support for the teaching activities, which included the presentation of all teaching materials, such as lectures and reports, on the eLearning portal of NULES and the project website. The project also created an online course on EU food safety official control at NULES LMS Moodle platform, which was accessible to students and professionals from different faculties, universities, organizations and projects in Ukraine. The project also organized open events via WebexEvent platform, which involved guest speakers

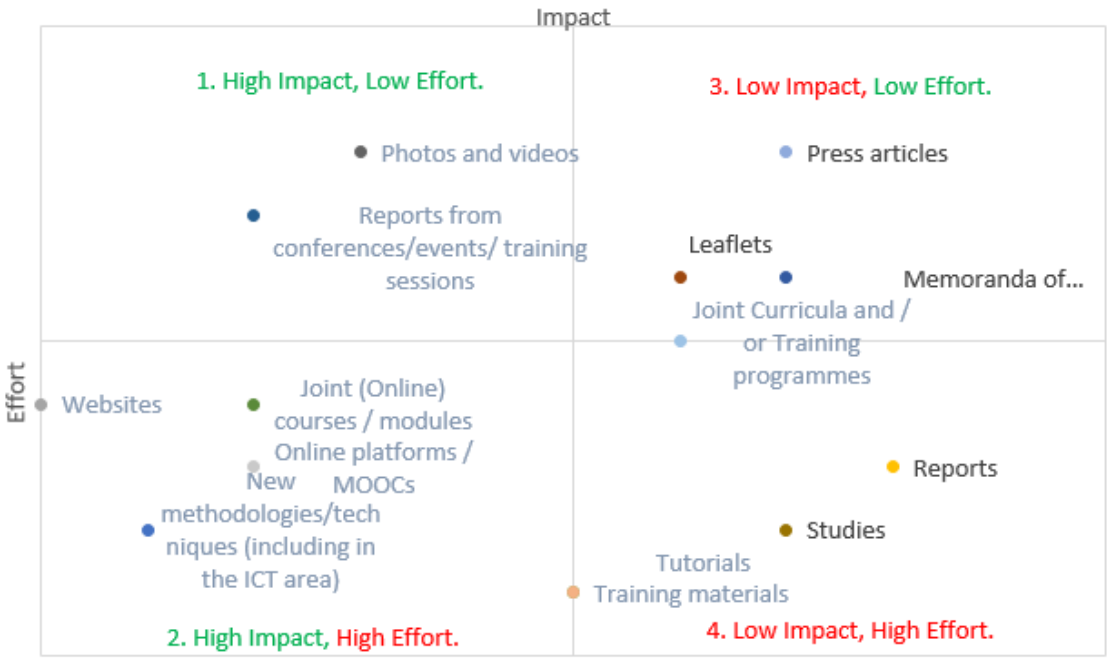

Figure 3: Impact effort matrix of project result.

from the EU and other countries, who shared their experiences and insights on food safety issues.

The project evaluated the outcomes of the teaching and dissemination activities by using a pre- and post-test assessment of the participants' knowledge on EU food safety control, as well as their feedback and satisfaction with the ICT tools and methods used for the module. The project also used the impact effort matrix technique to analyze the effectiveness and efficiency of the ICT actions taken for achieving the project results. The findings showed that:

- The participants' knowledge and awareness of EU food safety control improved significantly after completing the module, as evidenced by the increase in their test scores and their positive comments on the module content and quality.
- The participants appreciated the flexibility and diversity of the ICT tools and methods used for the module, as they enabled them to access the module materials and events at any time and place, and to interact with other participants and experts from different backgrounds and perspectives.
- The blended learning mode, which combined contact lectures and seminars with e-learning support, demonstrated better progress than the distance learning mode, which relied solely on online platforms. This suggests that a balanced mix of face-to-face and online interactions is more conducive to effective learning than a purely online mode.
- The ICT actions taken for achieving the project results were mostly in the high impact-low effort quadrant of the impact effort matrix, which means that they were easy to implement but had a significant impact on the project outcomes. This indicates that ICT can be a

powerful tool for enhancing food safety education in Ukraine and beyond.

The project demonstrated that ICT can play a vital role in supporting food safety education in Ukraine, especially in times of crisis such as the COVID-19 pandemic. However, ICT also poses some challenges and opportunities for further improvement, such as ensuring the availability and accessibility of digital resources, enhancing the quality and relevance of digital content, developing and assessing digital literacy, and addressing ethical and social implications of digital education. Therefore, it is important to continue exploring and evaluating ICT for food safety education in Ukraine and beyond.

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