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## An innovative short blended format for training graduate students to food chemical safety

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**Part 17 / Strand 17**  
**Science Teaching at the University Level**

*Editors: Jenaro Guisasola & Paula Heron*

## Part 17. Science Teaching at the University Level

University pedagogy. Teaching and learning at the university level.

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AN INNOVATIVE SHORT BLENDED FORMAT FOR  
TRAINING GRADUATE STUDENTS TO FOOD CHEMICAL  
SAFETY

1345

*Valérie Camel*

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# AN INNOVATIVE SHORT BLENDED FORMAT FOR TRAINING GRADUATE STUDENTS TO FOOD CHEMICAL SAFETY

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*A new innovative short blended teaching format is described here. It combines group activity in class based on a Thiagi frame game with production of graphical representations, and distance self-learning using open-access interactive digital resources organized in several successive modules. The total duration of the lesson is 7 hours, and its scientific content concerns the food chemical safety and related risk assessment. It is proposed in a Food Toxicology course of a second-year master degree academic program related to Toxicology and Environmental Health, with a majority of biological students as audience. Testing this new format with a cohort of students showed benefits: students were more engaged and encouraged to collaborate, learning from their peers through the production of graphical representations in class; in addition, success rates on the final exam increased. Because open-access resources were used to design this innovative teaching format, they could be used by colleagues interested in food chemical safety. Besides, the innovative format tested could be transposed to other teaching issues.*

Keywords: Cooperative learning, Graphical Representations, ICT Enhanced Teaching and Learning

## INTRODUCTION

Food safety is a major issue in the 21<sup>st</sup> century, as access to safe and nutritious food is crucial to sustain life, promote good health, and economic growth (Fung, Wang and Menon, 2018). Diet is recognized as a major contributor to exposure to several chemical hazards, with possible long-term deleterious effects on human populations. Several chronic diseases are suspected to be related to chemical contaminants in the food chain, such as obesity possibly related to endocrine disruptors. Future managers in the health or food sector need to be trained in food chemical safety, especially as several global factors (such as climate deregulation) are driving changes in food safety systems (Food and Agriculture Organization, 2006).

### The academic context

The graduate program considered here is the second year of a Master's degree in *Toxicology and Environmental Health*, delivering 60 European Credits (EC). Food chemical safety is part of one-week *Food Toxicology* course (30h, 3EC) placed at the end of the first semester and offered as an option to students. Students taking this course come from a variety of backgrounds (biological background with little knowledge of chemistry; biological or chemical engineering students; pharmacy or medical students; professionals wishing to acquire new skills). A 6-hour course dedicated to food chemical safety is taught in this course with a traditional format of two 3-hour periods and primarily transmissive instruction. The learning objectives are fairly high in Bloom's taxonomy, with the final exam requiring critical thinking and risk calculations. A portion of the course time is devoted to an exercise to familiarize students with chemical risk

assessment and to somewhat align the learning activity with the final exam, but the teaching method still needs improvement.

### **Theoretical considerations**

The learning modalities were designed to provide “E-focused” blended learning along Jone’s continuum (Chew, Jones and Turner, 2008), with interactive digital resources for distance learning and a student-centered pedagogical approach. Instructional techniques designed to have students work together in small, structured groups to achieve common goals (i.e. cooperative learning) were also considered, as group activities provide real opportunities for free discussion among students, with the potential to bring students into their zone of proximal development, thereby promoting learning and development (Eilks, Markic, Bäumer and Schanze, 2009). Tasks that require students to cooperate within the group are recommended (Gillies, 2016); producing a graphical representation seems to be an appealing option, as this task has been reported to improve scientific thinking (Fan, 2015).

### **A NEW STUDENT-CENTERED BLENDED FORMAT**

The innovative blended format is designed to integrate the above theoretical considerations: (i) interactive digital media for distance self-learning; (ii) cooperative learning; and (iii) the production of graphic representations.

#### **Session One: in-class cooperative learning (3h)**

This classroom session is based on a cooperative Thiagi frame game focused on the issue of consumer risk assessment due to neofomed toxic compounds, immediately following a short instruction to impart the required knowledge about these types of food contaminants. Named “*Group grope*” (The Thiagi group, 2016), the game is played in several rounds with students divided into defined groups (they were asked to pick up a playing card as they entered the classroom, to be quickly divided into groups). First, each student is given four blank paper cards, and asked to write a kea idea on each card related to the main topics of the course issue (e.g., what data to acquire, collect and combine to assess risk). The teacher then collects and shuffles all the completed cards, before redistributing three cards to each student; the remaining cards are left visible on a table. Students may swap cards with those left on the table or with their peers, while keeping three cards in hand. Later, students work within their group to select only three of their cards to keep, and to draw a graphic representation detailing the content of those three cards to explain how to assess the risk to consumers of a particular example of neofomed toxic compounds in food. A short time is set aside at the end of the session to give oral feedback on the students’ production, and to provide them with key knowledge relative to the risk assessment methodology.

#### **Second session: distance self-learning on a case study (3h)**


This session focuses on analytical methods for food chemical contaminants. The scientific content is available on the LMS platform, with distinct, short and successive modules (see illustration in **Figure 1**) offering different selected materials: texts and graphical representations, a short video, interactive digital educational resources in free access (specific pages of the CHIMACTIV website) and evaluation tests.

**Session on pollutants analysis**

Valérie CAMEL – november 2019 – *Food toxicology* course

This course will be tested this year in **distance learning**. A dedicated time slot is foreseen in the teaching unit schedule (November 28, 9:30-12:00), without the presence of the teacher. A **pedagogical scenario** has been elaborated to help you to appropriate the important knowledge on pollutant analysis - it follows a logical order with **several successive modules to be consulted in this order**.

You will be asked to produce a production (summary work) to help you assimilate the course content. This production must be submitted on the online course before November 29. A discussion and question period is scheduled on November 29 (11:15 - 12:15) in class with the professor. This will also allow you to discuss your productions.



Prerequisites
Problematic
Video analysis
CHIMACTIV consultation
Summary work

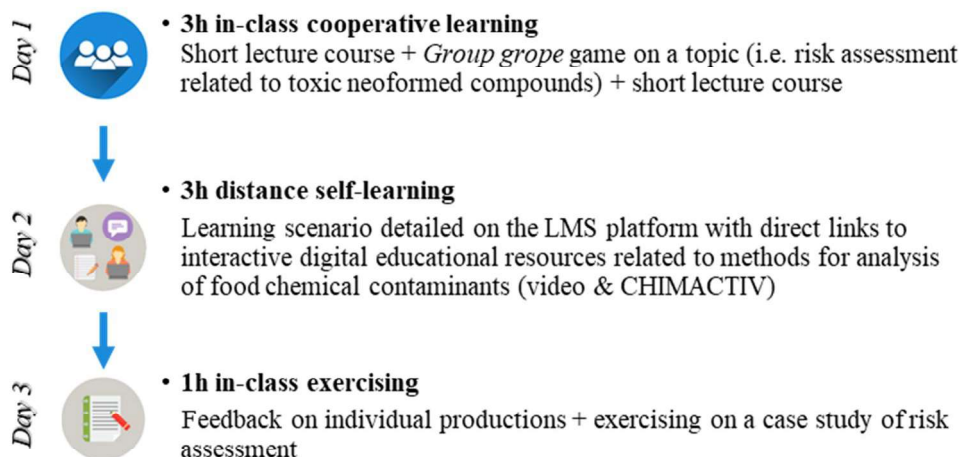
**Figure 1.** Home page of the asynchronous distance learning course offered on the LMS. (student view, originally in French and translated here into English; the modules images are interactive – by clicking on each module, dedicated pages and content are available).

Students are expected to consult these resources in autonomy and produce an individual assignment summarizing the highlights and ideas related to the course issue, with application to a case study on neoformed toxic compounds in foods. Instructions are given for completing this individual summary assignment, which must be submitted on the LMS platform by the last day of the course.

### Third session: classroom exercises (1h)

This session is devoted to giving feedback on the students' individual productions and answering their questions. Key points relative to food regulations are also presented, before practicing on a risk assessment case study.

The learning scenario finally designed and proposed to the students is illustrated in **Figure 2**.

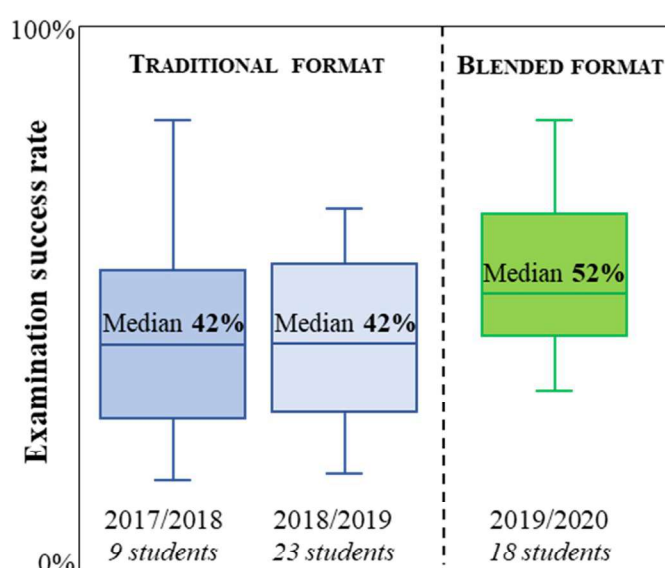


**Figure 2.** The proposed student learning scenario for the blended format.

## RESULTS

### Student views and academic performance

The detailed opinions, collected through an anonymous online questionnaire (18 respondents out of 18 students), were clearly favorable: 6 comments attributed the Thiagi frame game and the distance lesson as strengths of the course, and 2 comments suggested adding more distance lessons. The remote session was cited 8 times as a weakness due to the long learning time (several students spent nearly double the time to view the resources). When considering student academic performance on the food chemical safety portion of the final exam for this *Food Toxicology* course, a comparison of the last three cohorts clearly shows the median pass rate improved from 42 to 52% with the innovative instructional format, as illustrated in **Figure 3**.



**Figure 3.** Pass rate on the food chemical safety portion of the final exam for three cohorts of students taught in traditional (2 cohorts) or blended (1 cohort) mode. (median values as well as minimum and maximum values are shown).

### The teacher's perception and feeling

The positive attitude and commitment of the students during the Thiagi frame game was very impressive. They all made it through the session without taking a break, which would be unrealistic with transmissive teaching. This activity provided information about their prior knowledge, questions and learning difficulties for themselves and the teacher. Their final graphic representations were of high quality, as shown in **Figure 4**; the students were so proud that they took selfies of their group next to their poster.

For distance learning, even though the individual summary work was not concluded with a final grade, all students sent their production on time. The quality was somewhat uneven but quite satisfactory as shown in **Figure 5**, reflecting the time they spent consulting the digital resources and completing the assignment. With the exception of one student (who misunderstood the content), all students demonstrated their learning of the topic and thinking skills.



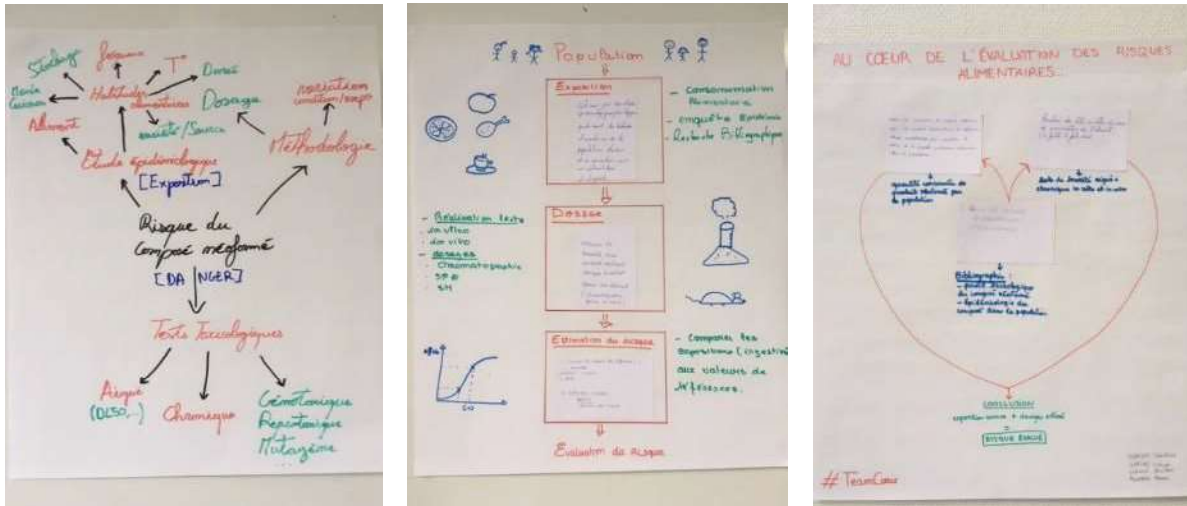


Figure 4. Classroom productions of student groups at the end of the Thiagi frame game.

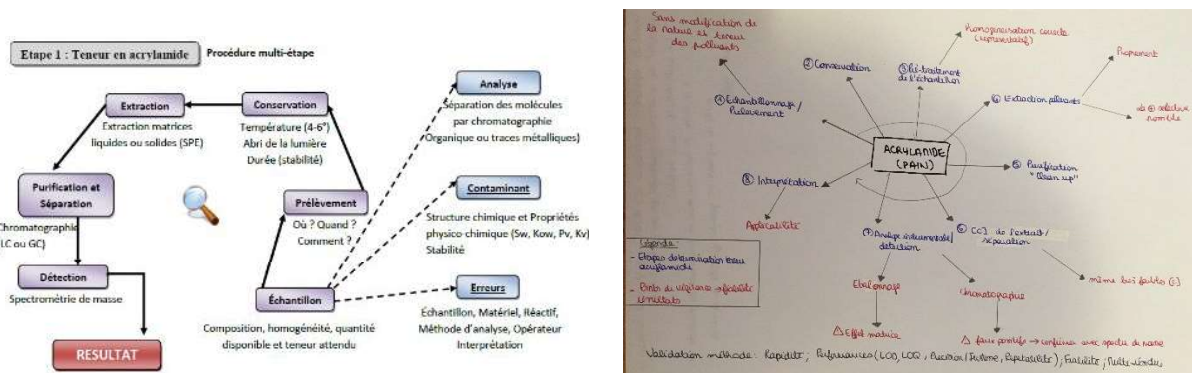


Figure 5. Examples of individual summaries completed in autonomy by students.

## DISCUSSION AND CONCLUSIONS

### Positive impacts on teaching and learning

The combination of an in-class cooperative work (with a graphic representation as output) and distance learning (with individual synthesis work) appears to be an innovative and effective short format for training master's biology students in food chemical safety. This student-centered format promotes student engagement in their learning, especially the cooperative learning activity as has been previously reported in higher education (Herrmann, 2013); student attitudes and engagement during this group activity are illustrated in **Figure 6**. Distance self-learning allows students to learn at their own pace with flexibility.

Feedback is improved for both the teacher (on the students' questioning and knowledge) and the learners (on their individual or collective productions); this is useful for quick remediation for both parties. This may have contributed to better learning compared to traditional teaching.



**Figure 6.** Groups of students debating which cards to select during the Thiagi frame game proposed in class.

### **A format easily transposed to other academic contexts**

Due to their simplicity, Thiagi frame games offer interesting alternatives to the Jigsaw class frequently proposed as a cooperative activity (Eilks, Markic, Bäumer and Schanze, 2009; Gillies, 2016; Karacop & Doymus, 2013). Developed and used primarily for corporate training, these simple games are freely available on the web with a wide variety that allows one to choose the appropriate game based on the pedagogical intent. Most of the interactive digital resources used in this study are also freely available (Camel et al., 2020). Thus, this teaching format can be easily used or translated to other scientific issues by colleagues.

### **Some pitfalls and limitations**

The amount of time spent preparing for the remote lesson is significant for the teacher. Another major constraint was to maintain a similar amount of time in the schedule so that the time spent on other lessons remains the same in the program. In the case of distance learning, time must be allowed for face-to-face discussions between the teacher and students, as the students are clearly in demand. It is also very important to take time at the beginning of the course to explain to students the pedagogical intent, and to carefully design the classroom and distance activities.

### **ACKNOWLEDGMENTS**

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