

## **FOSTERING CRITICAL THINKING WITHIN E-LEARNING IN THE WORKPLACE**

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This article investigates the complexities and necessities of fostering critical thinking within e-learning environments, emphasizing its significance for professional training. With the rise of e-learning modules, more companies are using them for the continuous training and development of their employees. These modules cover a wide range of subjects and domains, offering unique formats and styles that change traditional teaching by providing various activities. Do they meet the needs of training employees to think critically and adapt to become more competent? Critical thinking is essential in the workplace; without questioning ourselves, we would stagnate and remain stuck in fixed thinking patterns. How can we develop critical thinking skills in a professional context through e-learning modules?

Through our analysis of various studies, interviews with e-learning designers, and surveys of e-learners, we have identified key strategies that effectively promote critical thinking. These include the use of interactive elements, diverse formats, storytelling, and student-teacher communication within e-learning modules. Integrating these elements enhances critical thinking skills, preparing employees for modern workplace demands.

Despite challenges in experimentation and measuring critical thinking, our results are promising. We encourage further studies to improve these methods and explore new approaches for developing critical thinking in e-learning contexts.

*Keywords : e-learning, critical thinking, employee training, virtual learning, interactivity, storytelling*

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## Introduction

Adrienne Rich once said: “Responsibility to yourself means refusing to let others do your thinking, talking, and naming for you; it means learning to respect and use your own brains and instincts; hence, grappling with hard work.” In today’s world, where we are inundated with information through various mediums, the hard work that Rich mentions must be taught and fostered. A significant portion of the knowledge we acquire today comes through technology—videos, pictures, graphics—all of which offer little to no interaction and, consequently, little room for questioning.

According to Darshana Dutta, an expert on trends in company culture and employee engagement, many companies are choosing to train their employees through e-learning. E-learning involves engaging in courses online without the presence of a teacher and encompasses a wide range of educational platforms and methodologies. This shift allows organizations to save the time and money typically spent on in-person training sessions.

In her article, Darshana Dutta explains that employee training is crucial because it reduces the risk of incidents and mishaps, promotes safety, and ensures optimal utilization of time and resources. However, for this to be effective, employees must receive training that equips them with analytical tools and the ability to make informed decisions—in essence, training that develops their critical thinking skills. This brings us to the question of how critical thinking can be fostered in an e-learning environment.

The motivation behind our research stems from recognizing the challenges posed by the widespread adoption of e-learning. According to the manager of the Pedagogical Engineering and Digital Innovation Department of a large retail group, the primary objective of professional training is to equip employees with problem-solving skills and the ability to analyze situations and make informed decisions. With the increasing adoption of online learning, it has become essential to find ways to foster critical thinking skills among e-learners. Critical thinking skills encompass the abilities of discernment and analysis which are crucial in the workplace. Thus our research will ponder the question of how to foster critical thinking skills in an e-learning environment.

## Methods

*Describe how you led the research.*

To address this research question, we first researched studies that have already been done on the development of critical thinking skills through technology. We focused on research articles that present including experimental designs, quasi-experimental designs, and qualitative studies. Furthermore, we conducted a series of interviews with e-learning designers and experts in professional training and surveyed e-learners to gather insights into their experiences and perceptions regarding the development of critical thinking skills through online learning platforms. Our methodology included qualitative interviews to gain in-depth understanding from professionals involved in the design and implementation of e-learning programs. The surveys provided quantitative data to support our findings and offer a broader perspective on the effectiveness of e-learning in promoting critical thinking.

## Results

### **Research articles on fostering critical thinking**

We have found interesting results concerning the opportunities to foster critical thinking in the study led by Saadé, Raafat George, et al. presented in their article entitled “Critical Thinking in E-learning Environments” They have examined the learning behavior of 490 first year students of information and technology at the University of Montreal, Canada. Although this study relates to e-learning in higher education, we have found that many elements raised by the researchers deal with workplace training as well. The article highlights the importance of making the students active in their learning. The researchers present the students with different tasks to complete such as projects on Excel and Access, as well as assignments, projects and interactive tools like EISEL. In an online module, they are presented with activities and different resources (such as excerpts from physical textbooks, and different documents) to learn from. After the students have completed their tasks, they are asked which learning medium contributed the most to their critical thinking skills: the activities or the resources. The students voted in favor of the activities rather than the resources. Although the results seem to be clear, the researchers admit that age, learning medium and gender must be taken into consideration when interpreting the results of the study. They point out the limitations of their research and suggest that future research will have a more sophisticated methodology for measuring students' attention and focus during surveys. In conclusion, the

article concludes that the factor that impacts the development of critical thinking the most is interactivity within the module.

The second research article we have found entitled “The development of students critical thinking abilities and dispositions through the concept mapping learning method – A meta-analysis” and written by Barta, Andrea, et al. focuses on the consequences for critical thinking if the teacher were to add more detail. Thus, the article focuses on the effectiveness of e-learning in the classroom to promote critical thinking. The article focuses on the study of critical thinking in 17 students at the IKIM MATARAM Institute in Indonesia. The article begins by defining e-learning as: "the acquisition of knowledge and skills using electronic technology such as computers and internet, where some or all of the learning content is delivered digitally." The researchers in this study admit from the outset that e-learning is a tried and tested method for increasing learner learning due to the number of multimedia sources compared to paper-based learning. As a result, teachers are deliberately speeding up the application of e-learning in schools. In fact, teachers think that e-learning helps to speed up time and critical thinking. To understand if their hypotheses are true, the methodology of this study was 17 physical education students who took a test called the Ennis-Weir Critical Thinking Essay Test. The results of the test were analyzed statistically, as well as the use of the Internet by 76 teachers of mathematics and educational sciences in e-learning. The study of e-learning in teaching was measured in 52 subjects divided into five groups named personal development courses (6 courses) 14 scientific courses , 28 creative courses , 8 creative behavior courses , 4 departments were subject to the study ( biology, math, physics, chemistry). The data from the studies was all checked and given by the head of the department in each field. The nature of the data was judged to be qualitative and descriptive. The results and conclusions show that the homogeneity test was normal. Furthermore, the result of the critical thinking test shows a starting value ( $v_0$ ) for students' critical thinking was exceeded by the final value ( $v_1$ ) for students' critical thinking after e-learning. This result proves that the development of critical thinking through e-learning is clear as it has enabled students to move to a higher level. Above all, e-learning reinforces individual interaction with the subject being taught. As far as the results are concerned, 58.94% of teachers said that e-learning had a positive effect on student learning. However, the researchers believe that e-learning for critical thinking should be used even more extensively in teaching, as the results are satisfactory and promising, and that teachers should be trained in the use of this tool.

The third research article entitled “The Role of Critical Thinking in the Online Learning Environment” written by Kelly Bruning focuses on creating an exercise based on a problem called “The BUS105 :Create a Problem”. It integrates critical thinking into the online environment in order to achieve the goals of developing reflective critical thinking in students and to maintain an online learning community that can serve as a model for other online instructors. The study was first developed through the elaboration of an online course with the concepts while taking into account the accessibility and functionality of the course for students. The learning capabilities were summarized as follows: the ability to solve problems, the ability to communicate with other learners, the ability to use the English language in communication, the ability to read and then summarize. Finally, the ability to apply critical thinking concepts to course concepts. The aim of the study was to focus as much as possible on concrete results while paying particular attention to students' critical thinking in e-learning. Before starting the study, the researchers wondered how critical thinking could be stimulated without physical interaction. In fact, in the classroom, critical thinking is stimulated by the social interaction between the students and the teacher, which translates into questions that encourage reflection and criticism. Exercises in e-learning should therefore compensate for this major stage of critical thinking in students. In terms of methodology, the researchers in the study agreed on a definition of critical thinking, which is a broad and confusing term. In fact, the researchers chose to define critical thinking as "a set of knowledge, skills and attitudes (Watson & Glaser, 1964)". They also used the same critical thinking analysis tool by the same team that defined the term and the tool measures skills in inference, hypothesis recognition, deduction, interpretation and argument evaluation, all of which are used during the thinking process. To continue, for the assessment tools, they took in consideration the importance of the course, including problems in e-learning which counted for 20% of the mark. The online course requirements were detailed as much as possible with an orientation session for the course. Then, the teacher comments on problems created by learners by email in order to provide positive reinforcement. In addition, in the general knowledge of the course, "useful hints" (mini-courses that provide useful information to the student) have been added in each section of the course and examples of problem creation. Subsequently, the concept of nesting chapters in a hierarchical file structure has been developed so that students can easily find the course elements that relate to the specific units assigned. Next, the teacher decided to try and integrate student interaction into the creation of a critical thinking exercise. This exercise concentrates on the creation of a problem selected

for study. The aim of the exercise is to get students to create a problem using the concepts in the chapter. This allows them to relate the problem in their lives, incorporating the fundamental principles of problem solving into a story that another student will respond to. The aim of this exercise was to allow problem solving, but also addresses the student's concerns as they respond to their problems. The students were divided into pairs, chosen by the teacher, which changed every week. If pupil A is paired with pupil B, pupil A sends the questions in the "Create a problem" section to pupil B via the online course discussion thread. Student B then has a few days to prepare the answers. Student B posts his solutions to student A's problems on the link. Student A is now responsible for correcting student B's answer sheet and providing feedback on any incorrect problems. If student B does not answer the questions, another student can take his/her place as he/she is in the room discussion. The problem in the series total was worth fifteen points. The results show that the students thought the exercise was very positive. They also said that the critical thinking exercises prepared them to solve the reasoning problems that make up the majority of business mathematics exams. They look forward to having a new partner every week. To conclude, this research reveals that exercises based on storytelling allow learners to apply their knowledge in practice and thus develop their critical thinking skills.

The last research article is entitled "Promoting Students' Critical Thinking through Online Learning in Higher Education: Challenges and Strategies" and was written by Titi Tathahira. It begins by stressing the importance of technology in today's society and how it is ideal to take advantage of its development in the field of education. Tathahira argues that the primary skill of education, critical thinking, can be developed more strongly in online education. While the idea is a good one, they face challenges, but increasing critical thinking through education may be worth the cost. This research article reveals these challenges and how to overcome them with specific strategies. Firstly, the researcher assumes that the most accurate definition of critical thinking is that of Scriven and Paul (2003), who describe critical thinking as "the intellectually disciplined process of conceptualizing, applying, analyzing, synthesizing and/or evaluating information gathered through observation, experience, feedback, reasoning or communication, as a means of believing and acting." They believe that promoting critical thinking among students would enable them to take ownership of education by analyzing the links between fields and applying them to everyday life. This is because critical thinking is not just a "reflection" but an important skill required in the world of work. Researchers assume that the higher a student's level of critical thinking, the easier it is for

them to succeed in their chosen field. For the methodology, they use databases taken from *Google Scholar*, *Academia u*, *Research gate*, with the keywords "critical thinking", "e-learning", "critical thinking in higher education". They also use research articles on the subject, separated by theme. They started with research on so-called "descriptive" studies, with the following keywords in the research gate: the importance of critical thinking in education; challenges faced by learners challenges faced by learners in achieving high-level thinking through e-learning; strategies used by learners to overcome these challenges; strategies used by learners to overcome these challenges. They learned from this research that e-learning always has a flexible definition, which depends on the context, the domain and the author of the text. However, the term "e-learning" is interchangeable and can be written as "online learning" "media-based learning" "web-based learning". They learn that e-learning can develop e-learning through interaction with the student in online modules. The more interaction there is, the more critical thinking develops. The interactions that have been developed are the activation of self-efficacy in the analysis of instructions, the judgment of various information, and the search for truth and solutions. Even though e-learning enhances critical thinking, we must also consider the barriers that teachers may encounter during the design process. In fact, they may encounter socio-cultural barriers as teaching critical thinking to Asian students is not at all the same as teaching it to Western students.

We can conclude that these research articles on the possibility of increasing critical thinking via e-learning modules have come across both limitations and relevant solutions. Among the solutions to increase the development of critical thinking are the interactivity and the storytelling aspects of e-learning. Both aspects make the students active in their learning and thus better equipped to analyze information. Another important factor is the interaction between students and teachers, even online, which has been proven to be very beneficial for the development of critical thinking in e-learning modules.



**The survey results**

We then continued with a survey to find out roughly what the correlation was between critical thinking and the e-learning modules. Like the interviews, the word ‘critical thinking’ and any other form of synonym were forbidden. The survey was carried out by 20 people from our respective companies and the professional network of our research project manager.

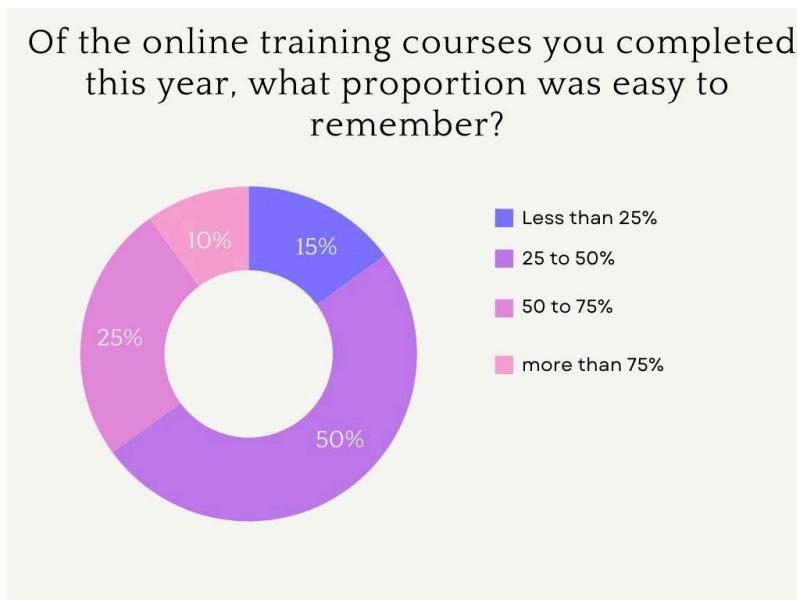


Figure 3 What proportion was easy to remember in the online training courses you completed this year ? Survey on 20 respondents, June 2024.

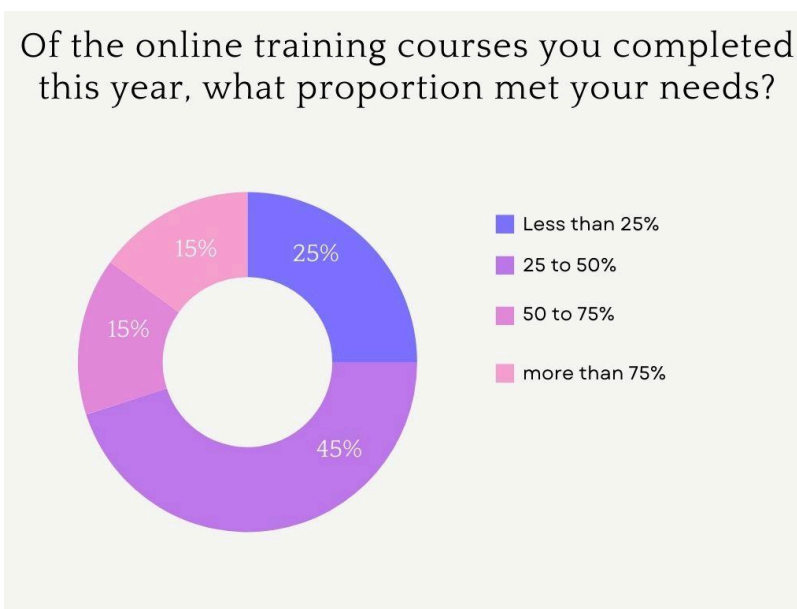


Figure 4 Of the online training courses you completed this year what proportion met your need ? Survey on 20 respondents, June 2024.

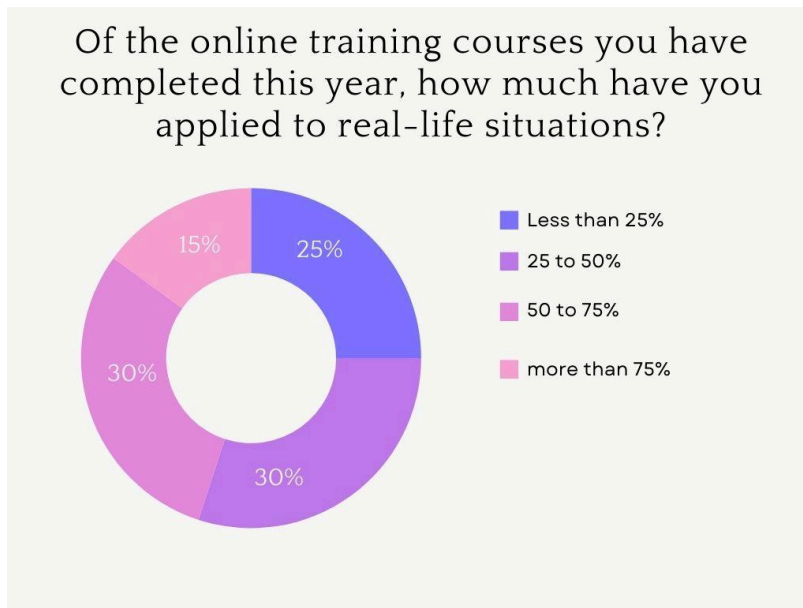


Figure 5 Of the online training courses you have completed this year how much have you applied to real-life situations ? Survey on 20 respondents, June 2024.

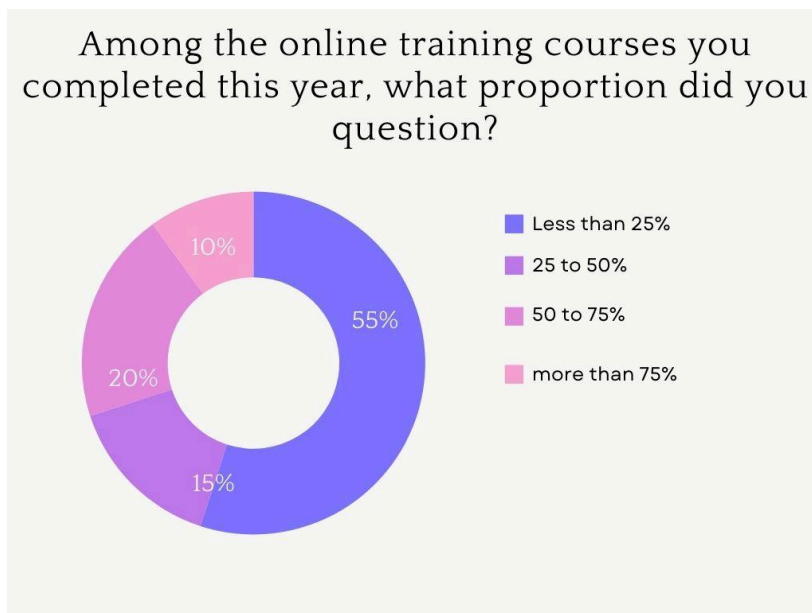


Figure 6 Among the online training courses you completed this year , what proportion did you question ? Survey on 20 respondents, June 2024.

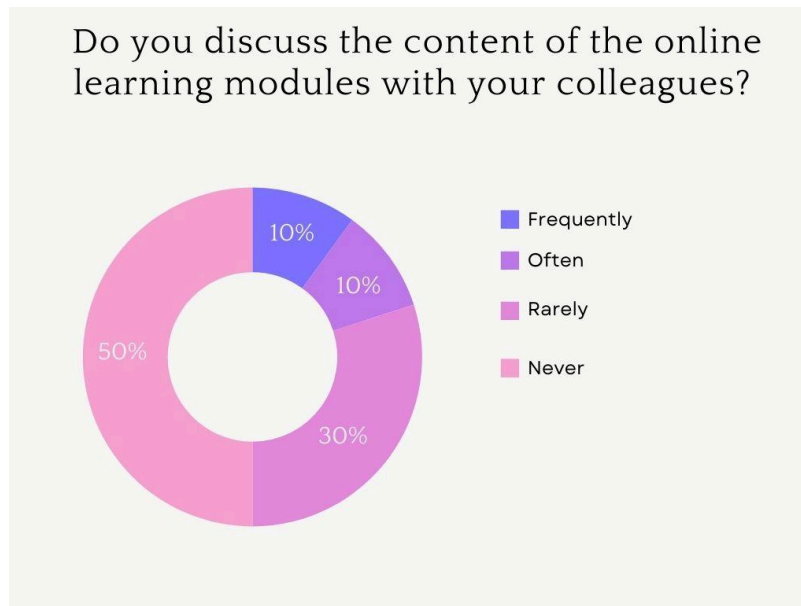


Figure 7 Do you discuss the content of the online learning modules with your colleagues ?, Survey on 20 respondents, June 2024.

This study shows that the 20 participants are often confronted with e-learning: 35% annually, 25% daily, 20% weekly, 20% monthly. An important point to highlight is the importance of interactive content for e-learning modules, with 30% preferring scenarios, 25% audiovisual content, 25% case studies and the quiz attracting only 20% of participants, the least interactive content. In addition, the majority of participants do not memorize almost all of the content of the modules (at least 75% of the content), which indicates a major need to improve the modules in order to improve memorisation. In fact, 50% of the participants memorize 25% of 50% of the content, 25% of the participants memorize 50% to 75% of the content, 15% of the participants memorize less than 25% of the content and 10% more than 75% of the content. One of the answers to this problem may be the fact that 45% of participants think that 25 to 50 % of the modules meet their expectations, 25% of the participants think than less then 25% meet their expectations, 15% of the participants think that 50% to 75% of the content meet their expectation and 15% more than 75% of the content meet their expectations. It proves that 70% of the participants think at least 50% of the modules do not meet their needs. In real life, 30% of participants applying 25% to 50% of the content of e-learning, 30% of participants applying 50 to 75 of the content in real life, 25% of participants applying less than 25% of the content in real life, 15% of participants apply more than 75% content in real life. This question indicates that e-learning content is not leisure modules but more modules for a professional purpose, even if all the content of the modules is not retained.

This is followed by the fact that 55% of participants questioned less than 25% of the content of the modules and only 10% questioned the information in the modules. Finally, more than half (55%) of participants rarely use external information to learn their e-learning, 35% never use external information for their e-learning content learning, 5% frequently use external information and 5% often. This question highlights, the lack of external curiosity for e-learning learning as the discussion of modules with their colleagues

To conclude, despite the usual e-learning modules of the participants, there is still a gap between what the participants of the e-learning modules expect and what the e-learning modules offer. The difference is that despite their questioning of e-learning modules, they are less likely to look for external information and talk about it with their colleagues.

### **The experts' input on fostering critical thinking in workplace training**

We have conducted interviews with e-learning designers from different companies that have developed internal employee training through e-learning. The first interview for our study was with an e-learning designer at a multinational energy company based in France. She indicated to us that she creates e-learning containing different formats such as videos and memo cards and says that different e-learning formats help to overcome the difficulties that an e-learning designer may encounter, i.e. too much text. Visual formats such as images and videos lighten the text content. In addition, learners are more engaged and attentive to the learning process. These formats also convey different messages, as she states “even if we try to convey the same message to the learners, the reception of this message will be different because the learners do not have the same perspectives”. Even if visual formats seem easier to interpret than text. It's the opposite, because images and videos require understanding of visual images, subliminal messages (symbols, color theory) and drawing conclusions as quickly as possible. Two other experts that were interviewed, from internal employee training departments, emphasized on the importance of creating a diversity in format throughout an e-learning course.

The second question focuses on the key skills that learners develop during e-learning modules. It states that finding information is a skill that they reinforce in each module. Learners reveal their ability to develop through the quiz, which asks for specific information that only learners who have looked for the information can answer. However, it's not that simple, as the information has to be dissected. So the second skill that learners develop through the e-learning modules is sorting information. This means analyzing and synthesizing the information acquired throughout the module, and selecting the most important answers during the quiz. Learners push their brains to sort and combine information to formulate a coherent, clear answer. The interview of a manager of the Pedagogical Engineering and Digital Innovation Department of a large retail group reaped similar findings as this, such as the importance of training employees to assess a situation and come up with their own solutions based on the information provided. According to him, this can be done by combining e-learning with good managerial supervision, in this sense the learner would continue to be trained on the job. This is to not only build good habits and reflexes but also to develop the correct thinking skills. The manager said that he was developing a learning system called AFEST which translates to “Planned and guided training through On-the-job training.” All four of our interviewees agree on the question of methods to assess the learners which is the immersion of the learner within a role play scenario in which they are faced with

a problem and need to come up with an answer. Adding to this, one e-learning designer that we have interviewed has put an emphasis on the importance of interactivity, and the development of game play in the assessment of the learners. According to him, the assessment is part of the learning experience and not simply a way to make sure the learner has retained information but a way for the learner to actively participate in the course. Finally, the interview concludes with the question of whether the learners have strengthened their e-learning skills. The e-learning designer says that she noticed that different scenarios in each module produce stronger results as the e-learning progresses. The further e-learning progresses, the fewer mistakes learners make and the more perceptive they become. The other interviewees have not analyzed the results of their e-learning as closely and have said that they produce content according to the goals of the course and the demands of the experts rather than according to the learners.

We can conclude from these interviews that critical thinking is fostered in e-learning modules thanks to the different learning formats, which encourage learners to think things through because of their different perspectives. They also need to be able to sort through as much information as possible to develop clear, comprehensible answers. The role-playing exercises, in which the learner is right at the heart of the action, reinforce their analysis, synthesis and critical thinking skills to find innovative solutions.

To conclude this interview, follows the logic of the correlation between multimedia elements and the high cerebral involvement of pupils. But also the interaction of students with increased critical thinking. She adds an important element of diversity: the more diverse the subjects students are exposed to, the better their attention and their resolution of final assessments.

## Discussion

Let us discuss the results of our research which aimed at answering the question of how to foster critical thinking skills in an e-learning environment. Our first step in this research was to conduct a state of the art to understand the challenges faced by e-learning teachers and the different discussions that were being held by professionals on the subject of e-learning and critical thinking. We have found that it is a very researched subject, many researchers are trying to develop ways to foster critical thinking within a virtual learning environment. The next step of our research was to conduct a survey among e-learning students which revealed that the courses provided have little impact on their daily lives and are often not analyzed by the learners. This corresponds to our initial hypothesis : the need to foster critical thinking, meaning the ability to analyze information and to adapt and transform it to one's needs, within e-learning. Moreover, the extensive research we have found on the different possibilities of fostering critical thinking in e-learning is also evidence that our initial hypothesis was correct. The interviews that we have conducted with professional e-learning designers revealed similar solutions to the problem which can be summarized as:

- 1. Interactivity:** The professionals and the researchers have both emphasized the benefits of interactive e-learning in developing critical thinking skills. They have argued that when the learner is active in their learning they will have a better understanding of the course as to when they are passive. Interactivity includes, quizzes, drag and drop, click buttons, as well as having to take notes during the online course.
- 2. Storytelling:** Involving the learner both intellectually and emotionally into the content of the course can enhance their capacity to analyze the information and apply it in other instances. In this instance, storytelling refers to immersing the learner within a scenario in which they must make decisions based on the information that was provided to them beforehand.
- 3. Student-teacher communication:** The research articles and the interviews have revealed that having interactions with a teacher is favorable to developing critical thinking skills. This includes the idea of having on the job training with a manager or a co-worker. In conclusion, e-learning does not have to be a fully independent adventure but can include webinars during which learners can ask questions as well as guidance outside the course.

In conclusion, our research has come to satisfying results despite lacking in experimentation. In fact, as mentioned in the many articles we have cited, the nature of critical thinking is that it is difficult to test and has many different definitions thus difficult to pin-down. However, we are satisfied with our findings and encourage further research in this subject.



## Conclusion

Our research has demonstrated that fostering critical thinking in an e-learning environment is challenging but essential for effective professional training.

Our study of existing research on critical thinking and e-learning highlights the importance of an interactive learning process and the exchange of ideas between learners and instructors, as well as among peers.

Based on our interviews and survey results, we found that maintaining communication between instructors and learners through webinars and on-the-job training effectively links learning and application. This combination enhances both memorization and the ability to analyze and react in real-life situations. When information is confronted with different ideas and shared from various perspectives, it reduces bias and promotes a mutual enrichment of thought processes. This dynamic exchange helps to move beyond fixed patterns of thinking.

We also observed that learners have diverse perceptions and worldviews, reacting differently to the same symbols and content. Therefore, it is important to diversify learning activities and the presentation of information. E-learning modules offer a flexible and dynamic platform for using various formats—text, icons, symbols, and audiovisual elements that facilitate a more successful learning experience.

Furthermore, interactive elements are crucial for developing critical thinking. Quizzes, drag-and-drop activities, and note-taking tasks have been shown to engage learners more deeply. The strategy of storytelling, which immerses learners in scenarios that require decision-making, also contributes significantly to their analytical skills.

By integrating interactive elements, diverse content formats, and continuous learner-instructor interaction, we can enhance critical thinking skills and better prepare employees for the demands of the modern workplace. Despite some limitations in experimentation and the inherent difficulties in measuring critical thinking, our findings are promising. The strategies identified in this research provide a basis for future advancements. We encourage further research to refine these methods and explore new strategies for fostering critical thinking in e-learning environments.

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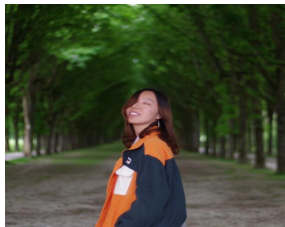
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