

A Review of Tools for the Design and Development of Online Interactive Gamified Content: A Simulation Study

Ludmiła Walaszczyk

Sieć Badawcza ŁUKASIEWICZ, Instytut Technologii Eksploatacji, Poland

Ludmila.walaszczyk@itee.lukasiewicz.gov.pl

Abstract: Nowadays on-line education has become extremely popular, mainly due to COVID-19 and social distancing. While more and more companies already offer on-line courses, a vast group of institutions stay away from such methods, mostly due to the belief that on-line learning may not be as effective as classroom training, the infrastructure required to deliver on-line courses is costly, the transformation of course content into digital interactive content is time consuming, and so forth. But the reality is that more and more learners find a lot of advantages in on-line learning. They wish to attend courses anytime, anywhere. There are thousands of pieces of open-source software and tools to choose from in order to create interactive content without the need of costly software, and infrastructure or coding. Even so, converting course materials to on-line digital interactive courses can be time consuming since a trainer needs to research for the appropriate tool in a vast market of free or low-cost open-source software, evaluate them, master their usage and then transform the content into digital interactive content. Time and human resources can be considerably minimised if organisations have access to a complete framework for the development of interactive, gamified courses by using open-source or low-cost software. The objective of this paper is to present and compare a set of selected digital tools which can be successfully used for the development of on-line interactive content in different types of institutions e.g., educational organisations, but also in companies during the process of organising training or courses for employees. Such a review is useful especially for the staff who teach the students using digital tools in order to improve the interest of the students and the effectiveness of their work i.e.: teachers, adult educators, VET educators, trainers, mentors or coaches. The paper offers them the opportunity to select the most appropriate tools for the teaching process. On the other hand, the target audience can also be the students who decide for self-learning. In this case, they can choose the tools which seem to be the most interesting and effective in their learning process. The identified tools were assessed by the VET trainers/educators in five European countries: Poland, Italy, Greece, Cyprus, and the United Kingdom (n=172). The research results indicate the most appropriate, friendly and free of charge open-source software used for the development of the interactive content. The originality of this paper comes from the fact that so far there has been no complex comparative analysis of the tools which can be supportive in the process of the development of the on-line training content with the use of interactive elements.

Keywords: E-Learning, Interactive Content, Gamification, Online Software, Online Platforms

1. Introduction

Nowadays more and more companies offer courses online, but still a vast group of organisations and trainers stay away from such methods, mostly due to the belief that online learning may not be as effective as classroom training (Hylland, 2022). We can try to guess what the reasons of such way of thinking may be.

1.1 Negative aspects and feelings of implementing digital tools

Over the decades, there has been more and more interest in equipping of educational institutions with digital tools (Flangan & Jakobsen, 2003; Cheng, 2019; Borawska-Kalbarczyk et al., 2019). It was a kind of the pressure to use digital tools (Säljö, 2010). On the other hand, the teachers were not informed which kinds of tools they should use, how to use them, how to improve the effectiveness of work and how to encourage the students to get more familiar with these tools (Afshari, 2009; Ghavifekr et al., 2016; Anggeraini, 2020). Another aspect concerns the students. They heard about the possibility of using digital tools, but they were not taught how to do it, which tools are the most appropriate for them, they did not have any instructive lessons (Sevara et al., 2022). According to Kolikan (2010), already in 2010 the students had high access to the Internet, but very low use of this technology (e.g., Veen, 1993; Cuban, 2001). The research mentioned by Kolikan concerned 40 countries: *“major investment outlays over the past 20 years have brought modern Information and Communications Technologies (ICT) into nearly all schools in the most advanced OECD countries, but the extent to which computers are in day-to-day use in these schools remains disappointing”* (OECD Report, 2004). After more than 10 years the situation has improved, but full success has not been achieved in this field (Bleakley, 2022). The students and the teachers have been using digital tools during lessons, but the digital offer is so wide, that they are often frustrated which tools to use and how to use them. For example, Bleakley indicates that the experiences with VRs are still frustrating. Similarly, Kee (2021) underlines the students’ fear and anxiety towards the use of digital tools. Some teachers may hold negative perceptions about online learning, citing concerns about the lack of face-to-face interaction and the perceived difficulty in delivering practical skills training through

online platforms (Ni, 2013; Syauqi *et al.*, 2020; Seyffer *et al.*, 2022; Bliuc *et al.*, 2012; Cechella, 2021; Desnenko *et al.*, 2021; Palomino, 2019). It is sometimes underlined that the infrastructure required to deliver online courses is costly. However, while there may be initial investments required for hardware, software, and network infrastructure, the literature suggests that the long-term benefits of online learning, such as scalability, reach, and cost savings in terms of physical facilities and travel expenses, can outweigh the initial costs (Kulkarni, 2013). Moreover, there are a lack of skills in the organisation to switch to online course delivery as well as numerous technical obstacles such as compatibility issues, programming complexities, and the need for specialized skills to create interactive elements. These challenges can increase development time and costs, especially for individuals or organisations with limited technical expertise (Irfan *et al.*, 2020).

It cannot be, however, assumed that the use of digital tools is related only to negative feelings.

1.2 Positive aspects and feelings of using digital tools

The literature offers numerous examples that online learning can be as effective as, and sometimes more effective than, traditional classroom instruction (e.g.: Barneva, 2017; Papadakis, S., & Kalogiannakis, 2019). Factors such as instructional design, learner engagement (Huang and Soman, 2013), and facilitation methods play crucial roles in determining the effectiveness of online learning (Papadakis *et al.*, 2023).

What is also very important nowadays is that the gamification aspects are included in the learning/teaching process (Zourmpakis *et al.*, 2023). Through the use of the digital tools, the students can learn easily through using games. The literature shows that the effectiveness of using games is assessed at a high level (da Rocha Seixas, 2016; Papadakis, S., & Kalogiannakis, 2019). This is especially important for the students with different learning problems such as the difficulties to analyse long materials or who are simply bored with the manuals (Bond, 2015; Behnamghadr *et al.*, 2021; Marinelli *et al.*, 2023).

The main objective of this paper is to present and compare the features of selected digital tools (22) which can be used in the learning/teaching process in different organisations. The author posed the following research questions:

- Which digital tools can be used in the improvement of the learning/teaching process of the students?
- What are the differences between the presented digital tools?
- Which of the tools can be especially implemented in the learning/teaching process enriched with the elements of the gamification?

In the literature we can find many papers devoted to digital tools and digital education. Mucundanyi and Woodley (2021) describe several digital tools which may be used in educational process, such as Digital Tools, Google Classroom, Google Docs, Google Scholar, Screencast-O-Matic, QuickTime Player, YouTube. However, the article is typically technical. The authors only include short descriptions of each of the tool in order to give an overview to the reader how the tool can be applied. The tools were not tested by groups of the students or teachers. In their paper, Baldwin *et al.* (2018) present six digital instruments which are applied in a national system. Similarly like in the first paper, they were not assessed by any of the target groups, at least this information is not included in the paper. Brown and Green (2016) indicate four randomly selected online tools which can be used in education. In many other scientific papers, we can find information about digital tools (e.g.: Tomiyama *et al.*, 2009, Jin & Bridges, 2014; Ragnedda & Mutsvauro, 2018; Jin & Bagaka, 2005), but there is a lack of the condensed information on different low cost or free tools which can be used in the educational process. What is a significant contribution of this paper is the fact that the author has performed testing of these tools with a sample of 172 VET trainers/educators. The results of the testing cause that the information about the potential use of the digital tool is more credible, because the target group was asked to implement the tool in selected tasks and activities.

2. Methodology

The following methodology was used in order to identify and select the most appropriate and useful software in the learning/teaching process and especially for the creation of a gamified interactive content for different types of end-users.

Step 1. The first step was to search for and test free-ware, open-source software and low-cost software for the development of gamified interactive content. During this activity more than 50 open-source software, free-ware

and low-cost software such as interactive videos, assessments, quizzes with hotspots, word banks, matching, put in the right order, memory games, drop down lists, fill in the banks, video recording and making, cartoons creation were identified. Each organisation from Poland, Italy, Greece, Cyprus, and the United Kingdom which took part in the research had to identify at least 10 pieces of software that can be used for the creation of gamified interactive content.

Step 2. The testing was circulated for peer reviewing followed by a 15-hour webinar (5 sessions – 3 hours each session) where each organisation presented their findings and provided a short training on the usage of the tools. Upon the completion of the webinar, the software (in the number of 22 pieces) which was the most useful, complete, easy to use and compatible with various LMS and CMS platforms was identified. This is the step which is described in details in this paper.

Step 3. Based on the final selection, the organisations were responsible to develop a guide for a set of software. The guide includes the list of the software containing the name of the software, an overview of its capabilities (in a table format) as well as an in-depth description what the tool is capable of creating/delivering, the pros and cons (if any), guidelines of installation and usage (online or offline where possible), a comprehensive training guide, links for downloading and compatibility with LMS and CMS platforms.

3. Research Results and Discussion

The pieces of software for the creation of gamified interactive content in the learning/teaching process which were presented and tested during the webinars are included in Table 1. As for each identified piece of software, the following elements were highlighted during the webinars: a short description of the software and its main capabilities; its features; the guidelines for installation and usage; the how-to / tutorial; the indication of the official website the generated content and compatibility with the LMS and CMS platforms.

Table 1 indicates only the names of the pieces of software (detailed descriptions can be found in the Toolkit for the Creation of Interactive Contents, 2023).

Table 1: The selected pieces of software

Name of the piece of software			
H5P	Adobe Captivate	OpenShot	Mentimeter
iSpring	Articulate Presenter	Reaper	Sticky Notes
Audacity	Elucidat	Shotcut	Student Quiz
Adapt Learning	Audiotool	Quizlet	Swipe
Debate	Real Time Quiz	Good Habits	Quizventure
Mindmap	Lectora		

Source: own study based on the work of different organisations in the i-CONTENT project.

Testing of the software

In the testing phase, there were 172 people engaged from Poland, Italy, Cyprus, Greece and the United Kingdom (table 2).

Table 2: Participant demography

Country	Poland	Greece	Italy	Cyprus	The UK
Number of respondents	72	25	25	25	25
Type of respondents					
VET trainers	23	20	18	21	21
Students	47	0	0	0	0
Other interested in the topic	2	5	7	4	4

Source: own study.

As it can be seen in Table 2, the participants for testing the software consisted mainly of VET trainers. In Poland there was an additional group of the participants who tested the software – the students of informatics and pedagogy for whom the development of the interactive content is important (n=47).

The participants evaluated the usefulness of the presented software taking into account their everyday activities based on the detailed information on each piece of software: the main capabilities of the software; features; the guidelines for installation and usage; the how-to / tutorial; the official website; the generated content and

compatibility with the LMS and CMS platforms (table 3). All these elements are described in details in the Guide "Toolkit for the Creation of Interactive Content".¹

Table 3: Evaluation of the usefulness of the software

Sections included in the questionnaire	Frequency (number of times as '5- excellent' and '4- good') in %	
How would you rate the overall usefulness of the presented software?	87	13
How valuable is the software in helping you gain new knowledge and competences?	79	21
Will you utilise the knowledge and skills gained whilst undertaking the software?	81	19
The presented software is appropriate to my professional needs (selected up to three software).	91	9
The software enables me to engage employees in the interactive design process of the creation of the training.	74	26
The identified software facilitates the development and learning process.	80	20
Mean:	82	18
Sufficiency of the software and efficiency of the process		
Do you think the competences related to the use of the presented software are useful in innovative and interactive organisations?	69	31
Do you think the identified software can easily be used by the training organisations to train managers and employees?	78	22
Mean:	73,5	26,5
Sufficiency of the software and efficiency of the process		
The quantity of information provided.	90	10
The quality of the content explained.	92	8
The language used in the description of the software.	89	11
Navigation and usability of the software.	87	13
Quality of the multimedia resources.	86	14
Form and organisation of the software on the original website.	87	13
Mean:	88,5	11,5
Grand mean:	81	19

Source: own study.

The software was evaluated positively, and was rated as excellent or good by VET providers, and in the case of Poland – by students. The participants admitted that the usefulness of the presented pieces of software is good or excellent (82% mean). The respondents admitted that the software can be easily used in the courses dedicated to the development of the gamified interactive content as well as while teaching students in different areas. Notably, 81% stated that they would use their competences and knowledge on this issue in their professional work. In particular, they paid attention to the software related to the creation of games, because the topic is especially fashionable at this moment in the training area. Surely, among the 22 pieces of software, the participants chose several of them stating that they are more interesting than the others. They appreciated especially the software related to the gamification which could be used in the interactive training (Caponetto et al., 2019; Nah et al., 2014; Kiryakova et al., 2014).

The participants generally agreed that nowadays the inclusion of the interactivity in the educational courses is crucial, because for the possible users the interesting course is very important. Although the sample for the testing was 172 people, the results cannot be generalised for the whole population. In this study the author invited the VET teachers and trainers for the testing, so the people for whom the digital tools are extremely important to engage the students more in the learning/teaching process. The average age of the teachers was 36 years old, so it can be assumed that these were people with sufficient knowledge of how to work with digital tools. We must pay attention to the fact that perhaps with another target group the results could be different, especially because of the age, geographical location or the types of the lectures led by the teachers. On the other hand, the author presents only the results of the testing phase, so the teachers were not able to use these tools in a real environment. Perhaps, after using the selected tool in a real environment, the results would be different.

The participants of the testing phase agreed with Bleakley (2022) that they had opportunities to use digital skills, but they were overwhelmed with a huge offer of different digital tools. Following with Kee (2021) they stated that not only students, but also teachers were always afraid of using digital tool, because they did not know how to do it, which tools were relevant for specific lessons, etc.

¹ https://icontent.projectsgallery.eu/wp-content/uploads/2022/03/ICONTENT-IO2_Software_Toolkit_V2.pdf

Apart from the overall evaluation of the usefulness of the software, the core element was to evaluate the engaging software including the gamification elements. Out of the 172 participants, 107 participants found the selected software to be highly engaging, 93 respondents found the selected software to be used in the development of the interactive course especially for young students, and 110 respondents stated that the learning-teaching process should include the software which can be easily used for the improvement of the education, both by teachers and learners. They confirmed that the effectiveness of using games is often assessed at a high level (da Rocha Seixas, 2016; Papadakis, S., & Kalogiannakis, 2019). What is similar to what was observed by Bond (2015) and Behnamghadr et al. (2021) is that the teachers sometimes use games during lessons with the students who have difficulties in learning, they have Asperger or autism syndrome. Such group of students like being engaged in games, but what is important they prefer using them for fun, obviously not for competing with the others.

The participants were also asked to rank the software including the gamification elements which was then synthesised to identify the most favourable software types. The combined frequency is summarised in table 4.

Table 4: Combined frequency of times software is collectively ranked in top 3

Selected software	Frequency (number of times)	Relative Frequency [%]
Adapt learning	47	9
Adobe Captivate	61	12
Articulate 360	85	16
Lectora Inspire	77	15
Blockgame	50	10
Bookwidgets	44	8
Camtasia	72	14
Elucidat	80	16

Source: own study.

For 94% of the respondents the elements of the gamification were very important. Some of them have had experience with the creation of games before, but for many of them it would be the challenge of getting started with eLearning, and creating good-looking courses quickly. Thanks to the presented software, it is possible to design beautiful eLearning content in minutes with the all-new ready-to-go slides. 87% of the respondents paid attention to the following aspects of the software: games (bingo, crosswords, hangman, etc.); pictures & videos (before/after, frame sequence, YouTube, Vimeo, etc.); math (active plots, arithmetic, charts, and spreadsheets); third parties (Google map, PDF, web embed, Wikipedia); miscellaneous (clear storage, planner, form/survey). What is important for the respondents is that with the use of the software, they can evaluate, grade, and provide feedback to their students: many exercises are automatically graded, freeing up time for you to give quality feedback to your students with a click. If they want to follow a student's activity live, they can monitor their students' progress in real-time while they're working, for example, on BookWidgets assignments, at home or in your classroom. Immediately they can discover students that need extra challenges, help struggling students, play live games, and take real-time surveys.

There are several software options available for developing interactive training courses, each with its own strengths and features. The choice of software depends on various factors, such as one's specific requirements, budget, technical expertise, and desired functionalities. The participants paid attention especially to the five pieces of software:

- *Articulate 360* (85 number of times) which is a comprehensive e-learning authoring suite that includes tools like Storyline, Rise, and Review. They underlined that storyline enables the creation of highly interactive and customizable courses with features such as branching scenarios, assessments, and multimedia integration. They appreciated that Articulate 360 offers a user-friendly interface, extensive templates, and a strong community support network.
- *Adobe Captivate* (61 number of times) was assessed as a powerful authoring tool for creating interactive e-learning content. The participants underlined that it provides a wide range of features such as responsive design, branching scenarios, simulations, and assessments. What is important, is that it also provides options for creating virtual reality (VR) and augmented reality (AR) content.
- *Lectora Inspire* (77 number of times) was perceived as an e-learning authoring tool known for its flexibility and extensive interactivity options. For the participants it was important that it offers a range of features, including customizable templates, multimedia integration, branching scenarios,

assessments, and gamification elements. What is more, they underlined the fact that Lectora supports SCORM and xAPI standards for seamless integration with learning management systems (LMS).

- *Camtasia* (72 number of times) was perceived as a tool which can be utilised to create interactive training videos. The participants indicated many advantages of Camtasia such as the capture and editing of screen recordings, webcam footage, and audio, along with adding annotations, quizzes, and interactivity. What is more, Camtasia is particularly useful for software demonstrations and tutorial-style training content.
- *Elucidat* (80 number of times) was seen as a cloud-based authoring tool that focuses on creating responsive and mobile-friendly interactive courses. The participants liked its user-friendly interface, a wide range of templates, and collaborative features for team-based development.

As a summary, the participants stated that gamification elements play a crucial role in educational courses due to their ability to enhance engagement, motivation, and learning outcomes. Here are some reasons why gamification elements are important in educational courses:

- *Increased Engagement*: Gamification elements, such as badges, and rewards, make the learning experience more engaging and enjoyable for students. By incorporating game-like features, educational courses capture students' attention and encourage active participation, which can lead to increased focus and retention of knowledge.
- *Motivation and Goal Orientation*: Gamification taps into students' intrinsic motivation by setting clear goals and providing immediate feedback and rewards. By offering challenges, levels, and achievements, gamification elements create a sense of progress and accomplishment, driving students to strive for improvement and complete tasks.
- *Active Learning and Problem-solving*: Gamification in educational courses promotes active learning by providing interactive challenges and problem-solving opportunities. Students actively participate, make decisions, and apply knowledge in a practical context, fostering critical thinking skills and enhancing their ability to transfer knowledge to real-world scenarios.
- *Personalized Learning Paths*: Gamification allows for personalized learning paths and adaptive content delivery. By tracking students' progress, performance, and preferences, educational platforms can tailor the learning experience to individual needs, providing targeted feedback and content that matches students' skill levels and interests.
- *Collaboration and Social Interaction*: Gamification elements often include social features, such as multiplayer challenges, or discussion forums. These elements foster collaboration, healthy competition, and peer interaction, creating a supportive learning community where students can learn from and with their peers, share knowledge, and engage in collaborative problem-solving.

4. Conclusions

In order to encourage both students and teachers to engage more in different courses, one of the ways is to propose to develop them in an interactive way. Nowadays, the students want to learn, but they do not just want to read simple texts. They want to learn with the use of their creativity and through fun and using different tools, such as games.

This article discusses the potential of the application of interactive software that aims to support digital competences in the organisation through the ability to develop an interesting interactive course. In our investigations we identified and tested a set of 22 digital tools with the group of 172 educators which can be useful in the learning/teaching process. In the article the author has made a condense review of selected tools in one place. And apart from the presentation of the tools, they also have been tested to guarantee more credibility in the selection and use of an individual tool in individual educational process.

This article has discussed and presented a pragmatic approach in designing and developing the educational resources for supporting the development of the competences. The participants underlined the following aspects:

- *Engaging and Interactive Learning*: Interactive software enables the creation of engaging and interactive learning experiences. By incorporating multimedia elements, interactive quizzes, simulations, and gamification elements, such software can capture learners' attention, increase their motivation, and enhance the overall learning experience.

- *Personalized Learning Paths*: Through assessments, learner analytics, and intelligent algorithms, the software can identify knowledge gaps and provide targeted content and exercises to address specific areas of improvement. This personalized approach allows learners to progress at their own pace and focus on the areas that require attention, enhancing their digital competences effectively.
- *Real-World Application*: Through interactive simulations, case studies, and problem-solving activities, learners can gain hands-on experience and develop skills that are directly applicable to their roles within the organization.
- *Assessments and Progress Tracking*: Interactive software can include built-in assessments and progress tracking features, enabling learners and organizations to monitor their progress and proficiency in digital competences. Regular assessments can provide feedback on learners' strengths and areas.

Having performed the research, some recommendations for practitioners can be indicated: the digital tools can provide training and support through organising workshops, webinars or tutorials; the use of the tools offers flexibility allowing practitioners to adapt the tools to meet their specific needs and align with their pedagogical approaches; and finally, the recognition of digital tools can inspire practitioners to explore them and experiment with new teaching methods.

The research has addressed the challenges associated with the development of the interactive training courses for different needs. The research significantly contributes to expanding the development practice in this area, specifically the design approach for the corresponding educational resources. The potential impact of the educational program designed and developed could be extended to consider more international dimensions as the outcomes can be further adapted by enterprises globally. Future work will also include correlating the engagement with the assessment of knowledge and competencies.

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