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Advancing NATO's quality assurance education by implementing the 'learn-watch-ask' training model

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Abstract

The paper introduces a detailed analysis and a method of implementing the "Learn-Watch-Ask" (LWA) training model, as a potential solution, to enhance quality assurance training within NATO. By addressing the fast-evolving demands of specialized domains, the LWA model integrates digital tools with traditional teaching methods to create a learning experience that is responsive to the student`s needs. The model is comprised of three interdependent components: the Learn module, represented by a structured online course; the Watch module, supported by a specialized YouTube channel for enhanced visual understanding; and the Ask module, created with an AI-driven chatbot for interactive learning. This innovative approach supports diverse learning styles, offering 24/7 accessibility and effectiveness. The paper further digs deeper into the identified shortcomings of traditional training models, emphasizing the need for practical, visual, and interactive elements in modern education. It explores the integration of the IBM WatsonX Assistant as a conversational AI chatbot in the LWA model, highlighting its advantages in providing consistent, accurate, and user-friendly interactions over Generative Pre-trained Transformer (GPT) AI models. Additionally, a 7-step process for adapting the LWA model to various domains is outlined, as well as the description of a comprehensive continuous improvement loop for the IBM WatsonX Assistant, ensuring its relevance and efficiency in the rapidly evolving educational landscape. The LWA model, with its unique approach to modern educational techniques, not only enhances the learning experience for NATO's Quality Assurance Course (S7-137) but also has the potential to be adapted across various specialized domains, promising a more effective and efficient workforce.

Keywords:
digital transformation in education; adaptive learning technologies; multimodal learning; artificial intelligence; e-learning models; conversational AI chatbot in education and training.

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The fast-evolving nature of specialized domains such as quality assurance in education and training, and especially within NATO's Quality Assurance (QA) Programme requires a new educational approach to train new specialists. It must be at the same time comprehensive and flexible. Traditional teaching methods are becoming increasingly insufficient in preparing professionals for the specific, complex challenges of the modern world.

This is the reason why we must look more and more to the digital tools and technologies available for free, or as a paid version when costless alternatives are not an option. Digital Transformation is a very complex process and requires both initiative and innovation at all levels of an organization.
Moreover, education and training are the pillars on which the foundation of an effective and efficient workforce is built. Specifically in NATO, it is a major contributor to a higher level of interoperability, every Member Nation is aiming to attain.

This document introduces an integrated educational framework, dubbed the "LEARN - WATCH - ASK" training model. It is specifically designed to enhance educational outcomes within NATO's Quality Assurance (QA) Course (S7-137) delivered at NATO School Oberammergau (NSO).
Using an online course, structured to teach the students solely the theoretical knowledge and concepts, a specialized YouTube channel to enhance understanding with visual aids, and a conversational AI chatbot to boost students' interaction and curiosity, this approach seeks to adapt to various learning styles while enabling effectiveness and 24/7 accessibility.
Extensive testing by analyzing multiple parameters, will be conducted, as a pilot project, during the November 2023 and January 2024 iteration of the NATO QA Course (S7-137), scheduled to take place at NSO. The analysis will examine the course's pass rate, the accuracy of students' responses in the final test, and the quantity of questions instructors must address after each lesson.
Furthermore, this study explores the broader applicability of the integrated educational model across various specialized domains.

The identified shortfalls at the NATO QA Course (S7-137)

As a consequence of the continuous improvement process conducted during multiple resident iterations of the QA Course, several shortfalls have been identified. This came as a result of observations, lessons identified, and feedback received from the students, and later on analyzed by the Quality Assurance Team of Experts (QA ToE), as the Allied Command Transformation`s (ACT) Officers of Primary Responsibility (OPRs) for the content and delivery of this particular course. The officers within the expert team are also senior associate instructors at the NATO School Oberammergau, ensuring the delivery of the entire study program.

In simple terms, three areas required particular attention and eventually improvement solutions. The first one stemmed from the obvious need for more practical work to be conducted during the five days allocated for the course. The training solution per se is classified in ETOC (Education and Training Opportunities Catalogue) as having a 300 level in the Depth of Knowledge – DoK. "DoK refers to the level of learning to be achieved as a result of an education and individual training solution. DoK is an inclusive term addressing the Cognitive Domain - Knowledge elements, as well as the Psychomotor Domain - Skill elements and, when appropriate, the Affective Domain Attitude/Values elements" (NATO 2015).
The skills and knowledge are delivered to the students through a mixture of theoretical and practical lessons. Based on this classification, we assessed that it is very difficult to achieve this proficiency level in such a relatively short amount of time. Obviously, due to objective reasons, increasing the duration of the course was not a viable option. The only way we could have approached this was just by increasing the time allocated to practical work.

Consequently, this is where it was decided that we could take out some purely theoretical lectures and create additional space for syndicate work, so stringently needed for the students to be able to perform their duties as Quality Managers without any supervision. Later on, QA ToE decided to develop an online introductory course based on the theoretical lectures taken from the residential course. The training solution created would become a prerequisite for students to be eligible to enroll in the residential course.

The second issue that emerged was the lack of video/visual content that could be easy to digest by the students. It is well demonstrated that visual learning is more effective, in terms of memory retention than reading text or listening. Various studies report that 75% of all information processed by the brain is derived from visual formats. "Visual learning also helps students to develop visual thinking, which is a learning style whereby the learner comes better to understand and retain information better by associating ideas, words and concepts with images" (Raiyn 2016).

Additionally, the concepts presented were sometimes far too complex for just one lesson. The only approach to simplify things was by using micro-learning techniques. Dividing complex content into bite-sized videos would be a lot easier to understand and absorb by the students. Having this strategy in mind, we started developing several short videos explaining complicated concepts. "Employing this strategy to create short (< 3 minutes) videos that intentionally highlight only 3 to 4 key objectives is consistent with the educational theory that reducing an operation into its component parts fosters increased proficiency" (Palmon et al. 2021).

Finally, at every iteration of the course during a period of two years, we noticed that a massive amount of the questions received from the students, as instructors, were repetitive and most of the time easy to answer. Therefore, when an instructor

is constantly bombarded with repetitive questions, it not only consumes a significant portion of his time but also diverts attention from focusing on more complex inquiries or advancing the proposed curriculum. This situation can lead to inefficiencies in the training process and potentially hamper the overall learning experience for students.

The solution could have been something from the realm of the new emerging technologies like Artificial Intelligence (AI). A software application that can respond to students' questions, ranging from simple to moderately complex, around the clock, and, at the same time, capable of learning. "AI technologies have the potential to transform the way research and education are conducted by automating tedious and repetitive tasks, assisting in data analysis, and enabling new forms of learning and assessment" (Kooli 2023).

The need to adapt – traditional vs. modern training models

In a traditional training model, the only interaction comes from instructors and trainees communicating with each other. Probably, this is what many of us might have grown up with. Conversely, a modern training method supports a better interaction of the students with the content. This 'Traditional' setting has its merits, but it also comes with inherent limitations:

- The one-size-fits-all approach does not adapt to individual learning paces. Some students may find the pace too fast, while others might find it slow, making the learning process difficult and rigid rather than flexible.
- Often, students find themselves with questions after class hours, but face constraints in accessing real-time assistance. Sometimes, because of different personalities, students will not feel comfortable asking questions in front of a large audience.
- Visual aids, which can significantly enhance understanding, are often limited or entirely absent.
- The experience of sitting through lengthy lectures while striving to understand each educational concept is a common challenge.

Taking into consideration the advancements in technology and the better understanding of pedagogy, ultimately the focus has now shifted to adapt to the learner's needs. "An important precondition for effective teaching is that teachers continuously try to obtain a valid picture of the extent to which their students are progressing towards the learning objective(s), and adapt their teaching based on that picture." (van Geel et al. 2023). As a consequence, several advantages need to be considered in a long term for this approach:

- The modern approach offers better support and emphasis on self-paced learning, allowing the students to consume theoretical content at their level of comfort through an online introductory course.

• By having an AI chatbot capable of answering questions 24/7, learners are no longer bound by time constraints when they have multiple questions or when they do not understand and they feel the need to re-study the content. The use of short videos ensures that complex concepts are broken down into simple content easy to understand, unlocking the full potential of visual learning.
• The relatively new concept of 'Microlearning' encapsulates the essence of modern education. It is about bite-sized digital content, be it through online courses, videos, or chatbots.
• Lastly, all these digital tools and resources can support opportunities like syndicate work or other types of hands-on sessions, ensuring knowledge is not just theoretical but also actionable, and can be applied by the students in their day-to-day jobs.

In conclusion, as we move forward, striking the right balance between these methods, and understanding when to use each, is the key to unlocking a comprehensive and effective learning experience.

The "Learn-Watch-Ask" (LWA) training model

Modern students need tools that are flexible, engaging, and above all effective. As an educational methodology, the "Learn-Watch-Ask" (LWA) Training Model stands out as a cohesive and versatile approach to enhancing learner engagement and comprehension. The model is comprised of three components that can be used synergistically to boost theoretical instruction, visual representation, and interactive querying.

*The '**Learn**' Component*. This is the starting point in which the students absorb the knowledge required for a specific domain through a structured content framework. Here, they are introduced to the core concepts, enabling them to build a robust theoretical foundation. Such a foundation is pivotal for subsequent stages, as it equips the learners with the necessary comprehension to advance to more complex practical training, should they feel the need to do so.

*The '**Watch**' Component*. Most of the content taught in a course can be more easily understood when it is delivered in a visual format. The component, through doodle-like animated videos, provides an additional layer of interaction, boosting the student's engagement during the delivery of instruction. In this vein, using a specialized YouTube channel, this component offers short, engaging videos that simplify complex ideas into easily understandable parts. The main advantage is that it will augment the retention capacity of the learners.

*The '**Ask**' Component*. In the age of speed and facile access to information, the 'Ask' component, within this construct, serves as a continuous learning companion. Powered by an AI chatbot, it can offer round-the-clock support, having the potential

to answer both simple and moderate complex questions posed by the students. The chatbot's 24/7 availability ensures that trainees have a reliable knowledge source, bridging potential comprehension gaps and reinforcing understanding as many times as they want.

As you can see depicted below in the *Venn diagram*, the real advantage of the LWA Training Model, however, lies in its ability to integrate each of the components individually into one another, in an interchangeable manner (see *Fig. 1*).

Figure 1 Intersections of the LWA Training Model components: A Venn Diagram

*The '**Learn**' and '**Ask**' integration*: By intertwining and re-using the content of the online course within the chatbot's answers database, there is a seamless integration of theoretical foundational knowledge and interactive querying. This combination ensures that each chatbot interaction not only addresses the question per se but also reinforces the core concepts delivered in the online training.

*The '**Learn**' and '**Watch**' integration*: Integrating the online course with pertinent videos fosters a multimedia-rich learning environment. This multimedia approach appeals to diverse learning preferences, ensuring that learners have multiple avenues to understand and internalize content.

*The '**Watch**' and '**Ask**' integration*: The mixture of visual content and prompt question answers represents the real advantage of contextual learning. As students navigate the video content, the chatbot can assist in clearing any ambiguities, potentially guiding them to other relevant visual resources. The videos can be integrated into the answers provided by the chatbot, adding more context.

The Advantages of the LWA Training Model

The LWA Training Model demonstrates multiple benefits, that can be utilized not only for the modern academic environment but also for broader training contexts, irrespective of the discipline or domain taught. This section aims to describe these advantages in greater detail.

Accessibility: The LWA Training Model ensures that no matter where you are or what time zone you are living in, you always can 'Learn', 'Watch', and 'Ask'. This means that the components and resources are accessible from anywhere, at any time. Whether the students are on the move, at the office, or at home, learning is at their fingertips, and accessible through all the mobile device types (mobile, tablet, laptop). If necessary, all the content of the components can be accessed without any type of account or login procedure.

Flexibility: This is where everyone learns at their own pace. The LWA training model is all about offering flexibility to their students. They can take their time, adapt the content delivery to their learning rhythm, and go back to any material whenever they wish to re-study it.

24/7 Support: Integrating an AI chatbot into the framework means that assistance is continuously available for the students. For any inquiry or any doubt, a learner might have regarding the course content, the chatbot is there to assist, ensuring that the learning process is not hampered due to unanswered questions.

Multimodal Learning: We came to understand that one size does not fit all in learning. The integration of text, video, and interactive elements supports different learning styles and preferences. Whether the student is a visual learner, auditory, or likes to read text, every aspect is covered within the components. "Multimodal learning is relevant as increases in technological tools and associated access to multimedia composing software have led to the ease of use of many modes in presenting, representing, and responding to information" (Bouchey, Castek and Thygeson 2021).

Cost-Effective: High-quality training does not always have to come at a high cost. Consequently, affordability often dictates the scalability and reach of any educational initiative. With the IBM Watsonx chatbot's free plan, we ensure that our platform remains budget-friendly while still delivering quality content.

Seamless Integration: Another great advantage of the LWA Training Model is the symbiotic relationship between its three core components: Learn, Watch, and Ask. This integrated approach ensures that learners transition smoothly across these elements, each reinforcing and augmenting the other seamlessly. Each component can be used in the other without the need for the instructor to know how to design

or code applications. Overall, it ensures a smooth and uninterrupted learning experience.

Security: Security cannot be compromised as it will affect the training provider`s credibility in the long term. The components used by the LWA training model are as secure as the cybersecurity standards followed by their developers. In this particular case, Google with its YouTube platform, is following industry-leading audits and certifications for customers, including compliance against ISO/IEC 27001/27017/27018 and SOC 1/2/33. IBM, as an industry giant, provides rock-solid security confirmed by the Trusted Supplier accreditation from the US Department of Defense (DoD), received in June 2023. Depending on the Learning Management System selected as the online course delivery platform, the security standards may be also different. The overarching aim regarding this aspect, should be securing the data in transit and at rest to the highest standards.

In essence, the LWA Training model is created to be a holistic experience with a major focus on modern learning characteristics. It is efficient, effective, and above all, tailored to ensure the best possible learning outcomes.

Understanding the difference between conversational and Generative Pre-trained Transformer (GPT) AI models

During the past decade, the utilization of artificial intelligence in education and training has gained significant traction. "AI is currently viewed by many as a driver that is integral to the fourth industrial revolution, and it may trigger the fourth revolution in education" (Zhai et al. 2021). Among the multitude of approaches, two mainstream models — Conversational AI and Generative Pre-trained AI (GPT) — as a manifestation of artificial neural networks and machine learning, stand out. This section aims to shed light on the distinctions between these models and evaluate their suitability for education and training delivery contexts.

Conversational AI: Commonly known by the majority of us as "chatbots", Conversational AI is designed to simulate human-like dialogue based on a predefined set of rules and responses. The AI technology stack, running in the background, helps the chatbot understand human language and respond accordingly. Below are the advantages that make this model perfectly fit for our purpose.

- *Consistency*: The most important feature I have found in Conversational AI solutions is its standardized responses. Regardless of the query phrasing posed by the student, the output remains unchanged, ensuring coherence in the knowledge delivered. Creativity offered by the GPT model would render the answer inconsistent, which would confuse the student even to a greater extent.
- *Accuracy*: Based on the principles on which it has been designed, Conversational AI returns accurate and validated answers, therefore offering

clarity to the learners and, more importantly decreasing potential ambiguities. This is one of the strongest points that makes it suitable for the academic environment. The creation and validation of the answers is done by multiple humans as subject matter experts, and it represents the supreme confirmation of the content accuracy provided.

• *Ease of Implementation*: The integration of Conversational AI into any type of Learning Management System (LMS) is very straightforward, typically necessitating minimal or no code adjustments. With just a few lines of code, predominantly JavaScript, the chatbot interface can be embedded in any webpage, irrespective of the script language used to design it.

• *Intent Recognition*: While both AI models possess intent recognition capabilities, Conversational AI is inherently more proficient and finely tuned specifically for understanding the user intent. No matter how the student phrases an intent, the AI will detect the intent and will provide the exact answer linked to it. (e.g., What is Quality Assurance? – What can you tell me about QA? Do you know the details about QA? – as intent rephrasing). In this case, the user would intend to find out information about the Quality Assurance.

• *Simplicity*: Creating and designing a chatbot, using modern no-code platforms can be very simple and straightforward. Any employee or team of employees can build a chatbot in a very short time, just by using a friendly user and intuitive interface. It eliminates the need for expensive developers and empowers virtually any employee with minimal knowledge to be able to design various chatbots in a very short time for the benefit of the organization.

Generative Pre-trained Transformer AI (GPT): GPT AI-based technology, on the other hand, is characterized mostly by its generative abilities, producing content based on the immense training data it had been fed with, rather than stable, clearly defined responses. Before trying and adopting the conversational AI model for this project, GPT technology was extensively tested to assess if such a model could be adopted. Below you can find the main challenges identified during the design and testing phase.

• *Consistency*: Taking into account its generative/creative focus, GPT can provide in most cases different answers to identical prompts. By always providing diverse texts, this issue potentially undermines the quality of the learning experience the students expect to receive.

• *Accuracy*: In some instances, I observed that GPT might fabricate information or generate misleading details, commonly named 'hallucinations', even when the Chat GPT version 4 engine was used and only pre-trained with data/text contained in just three framework documents. Such inaccuracies can be very dangerous, especially in academic environments, where factual precision must be the only concern of both instructors and students.

• *Bias*: 'Despite opposing views regarding the nature of intelligence exhibited by Large Language Models (LLMs), a relatively undisputed topic is the issue of bias. Bias, in the context of LLMs, has recently been studied as the presence

of misrepresentations and distortions of reality that result in favoring certain groups or ideas, perpetuating stereotypes, or making incorrect assumptions.' (Ferrara 2023). AI bias occurs when an algorithm produces systematically biased results because of flawed assumptions in the Machine Learning (ML) process. This problem can manifest even with relatively small quantities of data or documents, and most likely, even when adjusting various parameters, it is beyond the control of the developer using LLMs like ChatGPT.

- *Complex coding and implementation*: Additionally, unlocking GPT's enormous potential often requires diverse coding skills, ranging from creating simple scripts based on Application Programming Interface (API) queries to complex applications written in Python, PHP, Ruby, or Go. This challenge can lead to increased complexity and costs of the entire project.

Concluding, it turns out that Conversational AI had higher potential and compatibility with the LWA Training Model`s requirements than GPT-based AI. Because knowledge and accuracy are crucial in an educational environment, Conversational AI continually offers precise answers selected from a pre-defined database. On the other hand, whilst GPT is clearly outstanding in the creativity of texts provided, its versatility does not necessarily support the demand for scholarly objectivity. Therefore, Conversational AI offers a greater comprehensive fit for a much less complicated and dependable training model, like the LWA.

Enhancing the LWA Training Model with IBM WatsonX Assistant

All the advantages that emerged during the multiple tests conducted to determine which AI model is properly aligned with the proposed objectives, ultimately pointed to the adoption of the IBM WatsonX Assistant product as the Conversational AI chatbot within the "LEARN - WATCH - ASK" (LWA) training model. The IBM WatsonX Assistant is a mature, secure, and cost-effective product, compared with similar other ones present on the market. The Lite version used in the LWA is offered free of charge, which is a huge advantage for tight-budget projects. Having Natural Language Processing (NLP) capabilities, it is specifically designed to provide consistently the right answers the learners need when posing their questions.

The Conversational AI Chatbot does not necessarily provide just simple answers based on pre-defined keywords. It understands, then determines the intent, and finally provides the correct pre-trained content as answers. Based on pre-designed conversational flows, combined with monitoring student engagement, the AI Chatbot can enhance the learner`s experience by making it more personalized and efficient.

Ultimately, by adopting IBM Watsonx Assistant in the LWA training model, the aim is to automate responses to frequently asked questions. As a consequence, the

instructors have the flexibility to focus more on complicated topics, ensuring that they can dedicate significant time to practical sessions as well. AI, in this context, is not replacing the human touch. On the contrary, it's amplifying it.

Designing a conversational AI chatbot based on IBM WatsonX Assistant

The chatbot, named Qbot, was designed particularly to answer simple NATO Quality Assurance topics, based on the trending data generated by the iterations of the NATO QA Course (S7-137), conducted during 2021-2023. Grounded on this analysis, all the queries identified as frequently asked questions were translated into intents (see *Fig. 2*) and added manually to the Chatbot`s database. Each intent was defined as a question phrased differently several times to train the AI to better understand the student`s intent and provide the correct answer.

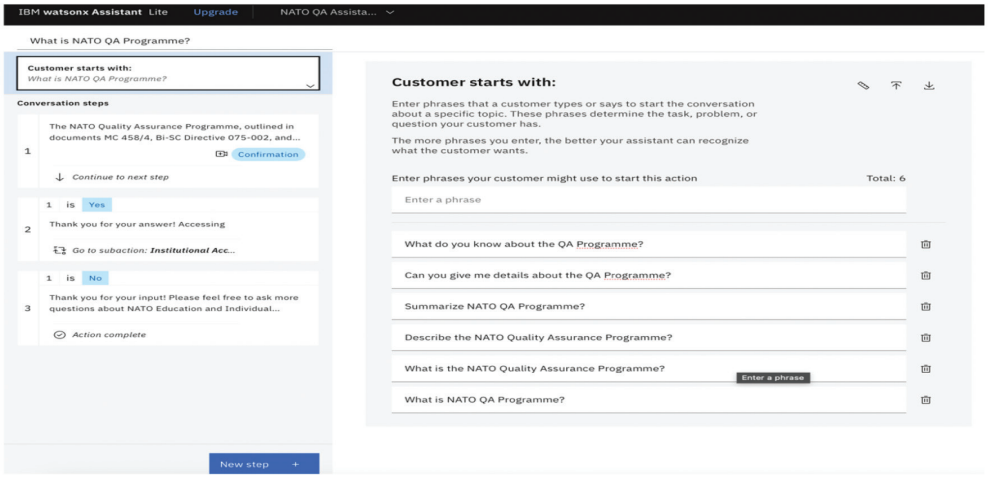

Figure 2 Defining an intent as a question phrased differently multiple times to train the AI (Admin interface)

Figure 3
User`s starting screen

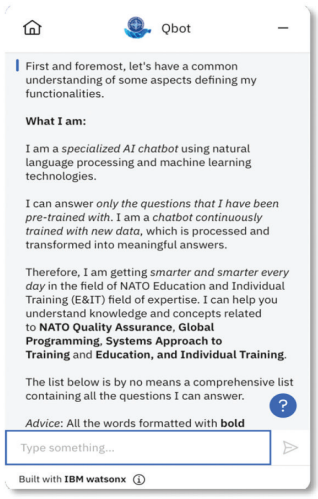

Figure 4
Answering an intent

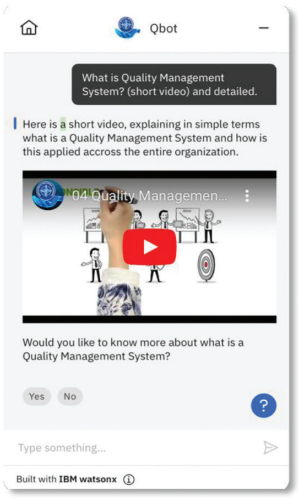

Figure 5
Answer with video

The front-end (user) graphical interface of the Qbot is clean and straightforward offering the students the opportunity to focus on the content provided as answers. Following the same design principle of simplicity, the starting screen contains five questions as examples, inviting the learners to get creative and address more questions (see *Fig. 3*).

The Qbot offers versatility in terms of providing answers to the end users. The text can present the possibility to be formatted when added as a pre-defined answer, to a particular intent registered in the database (see *Fig. 4*). Additionally, the text can be complemented with YouTube-embedded videos, significantly enhancing the students` understanding (see *Fig. 5*).

Intents and answers registered in the Qbot`s database can be continuously increased and improved as needed. The effectiveness of the chatbot in responding to questions addressed will be directly proportional to the quality of the answers it is supplied with; therefore, continuous improvement is paramount.

Applying the LWA Training Model to different domains/disciplines

The versatility of the "LEARN - WATCH - ASK" (LWA) Training Model can be potentially extended beyond its initial implementation within NATO's Quality Assurance Programme and its Community of Interest. The training model can theoretically be adapted across various domains, disciplines, or particular fields of knowledge. This section outlines a systematic 7-step process, that demonstrates how the LWA Model can be adjusted to different sectors, ensuring its effectiveness and relevance in multiple educational contexts (see *Fig. 6*).

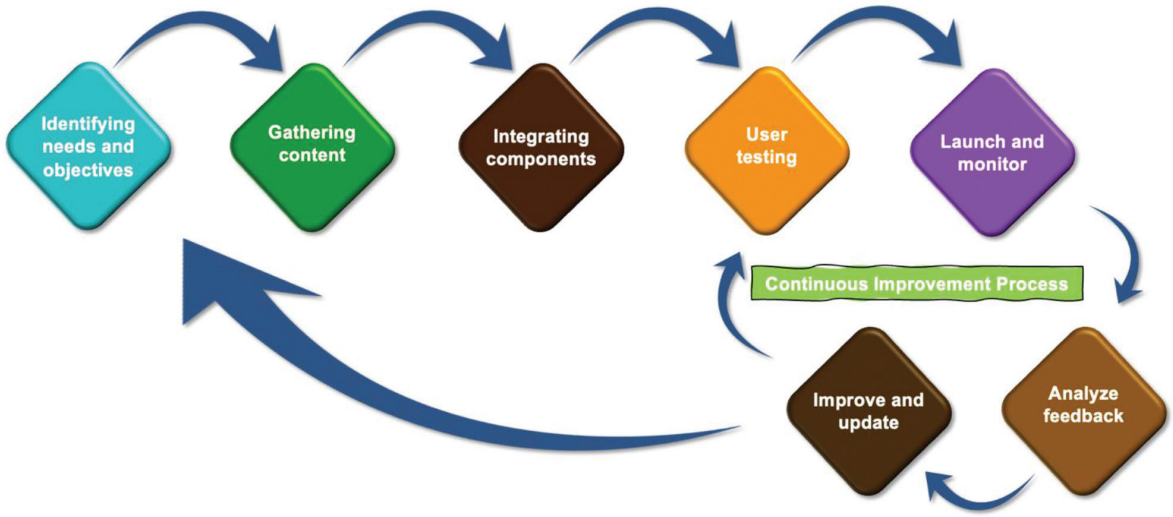

Figure 6 Steps taken when applying the LWA Training Model to different domains/disciplines including the Continuous Improvement Loop

Identifying needs and objectives: The initial step involves a detailed analysis to understand the specific training needs and objectives of a particular domain in which you are planning to apply the LWA. One of the most important questions to ask should focus on identifying the goals aimed to be achieved with the LWA Model in the new domain. Clarifying these objectives, as early as possible, is essential for maintaining the implementation process in the right direction.

Gathering content: Content should be the cornerstone of all the components of the LWA training model. This step focuses on sourcing and organizing domain-specific materials that align with the three components of the LWA model: Learning (online course material), Watching (video content), and Asking (defining the answers for the chatbot intents). The emphasis should be put on ensuring that the learning content would not only be relevant but also custom-made for the intended target audience.

Integrating components: The LWA training model should be designed as a seamless user experience. This is one of its most important advantages. During this phase, the components should be integrated – online course, videos, and the chatbot – to be capable of using the content interchangeably. This combination aims to provide a cohesive and uninterrupted learning experience for the students.

User testing: Before a full-scale rollout, the adapted model should undergo rigorous user acceptance testing. From this perspective, this is a critical phase to verify the various indicators like effectiveness, ease of use, and student`s understanding of the content delivered by the three components. The intermediary feedback gathered during this stage is invaluable for fine-tuning the LWA training model during the next phases.

Launch and monitor: Following thorough preparation and testing, the LWA training model is then launched for the targeted audience, while close monitoring of performance metrics, already agreed upon, is crucial. This continuous observation helps in understanding how the training model is being received and utilized effectively and efficiently by the learners.

Analyze feedback: From the perspective of continuous improvement, an essential component of the model's 7-step lifecycle is the active collection and analysis of learner feedback. This step is fundamental for keeping the LWA Training Model relevant, engaging, and responsive to the learners' needs and preferences, based on the inputs received through the monitoring tools of each component.

Improve and update: Finally, after all the feedback has been collected and analyzed, the last step involves updating the components, specifically the Qbot, with the content created as a result of the previous steps. Although it is the last step in the continuous improvement process, this should not be regarded as a final action, but rather as a trigger to restart the whole process if needed. For instance, based on the

refined inputs there might be a need to go revisit step 1 and re-identify the training needs and objectives. (see *Fig. 6*) The feedback loop together with this final step can serve as a basis for improvement for any of the steps in the components` lifecycle.

By following the steps described above, the LWA Training Model demonstrates not just effectiveness but also remarkable adaptability to the feedback received from the learners using it. It can be customized to meet the specific requirements/needs of various educational sectors, thereby maximizing its impact and utility across online and in-person learning environments.

Applying the continuous improvement loop to the IBM WatsonX Assistant through monitoring and feedback analysis

From the quality assurance point of view, monitoring, and feedback are the critical steps that underpin continuous improvement. This process of ongoing refinement and updating helps maintain the component's overall effectiveness, addressing emerging requirements to stay relevant, as well as enhancing the learners` experience. The following section describes a comprehensive 6-step approach to continuous improvement, that can be applied to the IBM WatsonX Assistant, which is the 'ASK' component, within the LWA Training Model (see *fig. 7*).

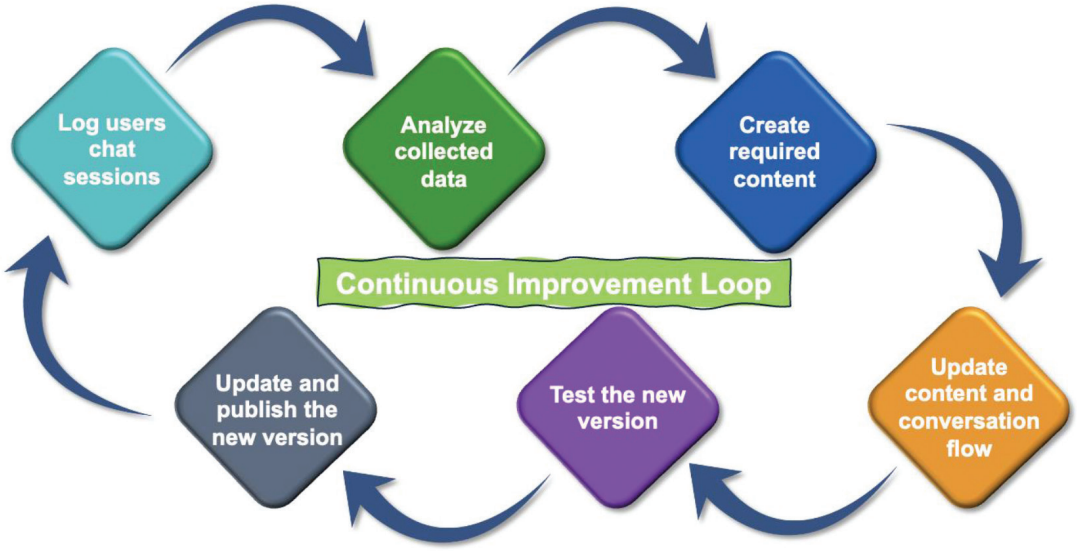

Figure 7 IBM WatsonX Assistant component 6-step Continuous Improvement Loop

Log users` chat sessions: Data collection is the first step that must be performed when applying Continuous Improvement. By meticulously logging user chat sessions, invaluable real-time interactions and feedback can be aggregated for further interpretation. This data serves as the raw material for analyzing and providing a window into the user experience, while ultimately highlighting areas for potential enhancement (see *Fig. 8*). Over time, as the data gets collected certain patterns, as well as anomalies or errors might emerge. Specific questions might be asked frequently,

revealing areas where the content delivered needs further clarity, emphasis, or new topics need to be addressed as potential answers. While these interactions are logged continuously, data protection and privacy are preserved during the entire process. Personal Identifiable Information (PII) is anonymized, ensuring that the platform used remains aligned with the regulations specified in the EU GDPR and US Privacy Act.

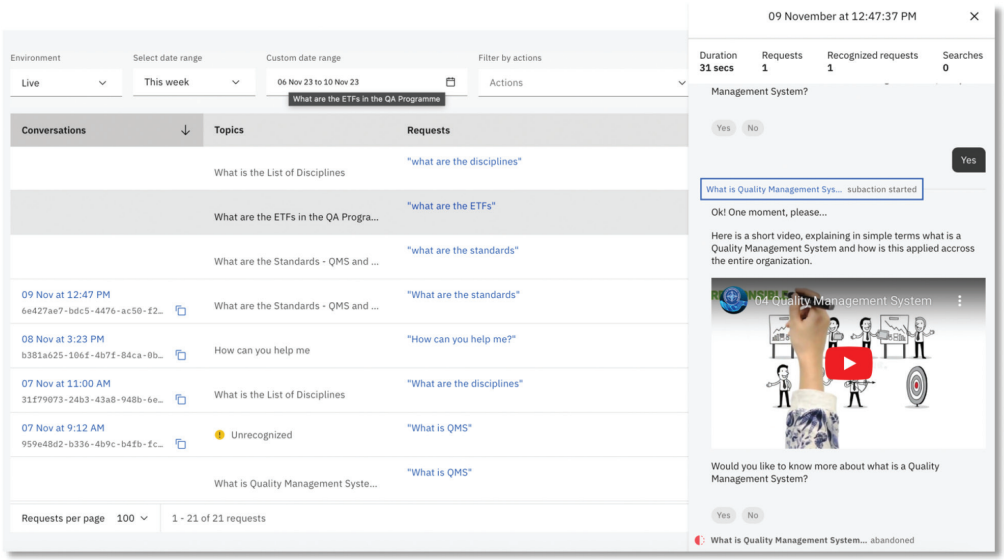

Figure 8 IBM WatsonX Assistant admin interface view for logged user chat sessions

Analyze collected data: The large amounts of data collected during *Step 1 – Log users` chat sessions* – represent just unfiltered information, that does not offer any potential for a meaningful interpretation. Further refinement is required to draw any conclusion. Analysis is the process of turning these raw data points into actionable insights. To achieve the desired goal, several analytical processes need to be performed during this step.

- *Pattern recognition*: By examining the logged chat sessions and recurring questions common misunderstandings can be identified, or areas/topics that are of high interest to the students. Recognizing these patterns/trends within the data flows allows adjusting the content delivered as pre-defined answers accordingly (see *Fig. 9*).
- *User behaviour understanding*: Beyond the direct questions that return a pre-defined answer, the data captured tells a story about the user`s/student`s behavior. Which topics do users frequently prefer? At what points do they seek extensive chatbot assistance? Understanding this behaviour helps create a more intuitive student learning experience.
- *Gap identification*: This is one of the most important analytical processes performed within the Continuous Improvement Loop. Attention should be directed towards the questions that the chatbot is frequently unable to answer. Additionally, these gaps are a crucial factor for optimization, because they can uncover other areas where the content or chatbot`s conversational flows might need enhancement (see *Fig. 10*).

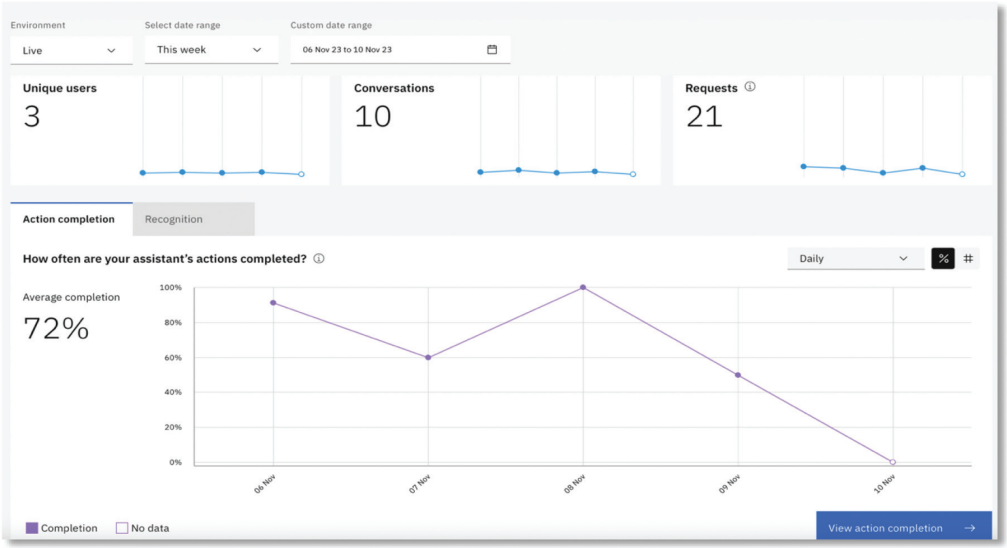

Figure 9 IBM WatsonX Assistant admin interface view for understanding user behaviour

• *Performance metrics*: The chatbot's success will be quantified using metrics like average completion rate, response accuracy, and engagement time duration. These statistics will offer a clear baseline that can be used to detect where improvements are needed (see *Fig. 9 – average completion rate*).

• *Feedback prioritization*: Not all feedback is of equal importance. By thoroughly analyzing the data, prioritization must be made to identify which areas to address first, ensuring the most pressing user needs are met promptly.

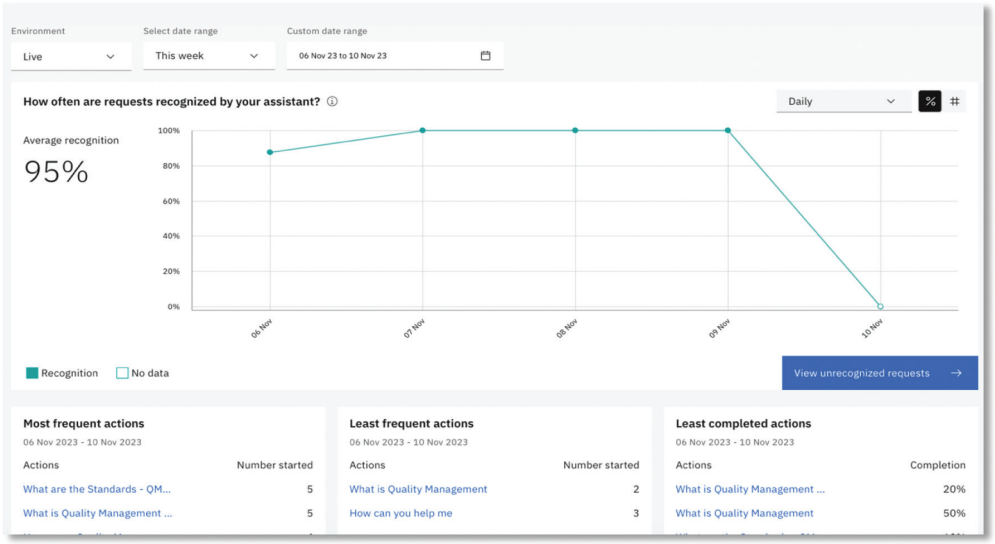

Figure 10 IBM WatsonX Assistant admin interface view for unrecognized requests

• *Create required content*. After the complex task of collected data analysis is completed, the laborious step of creating the required content, in response to the identified gaps, comes into play. The sub-steps performed guarantee that the new pre-defined answers will be relevant and properly optimized

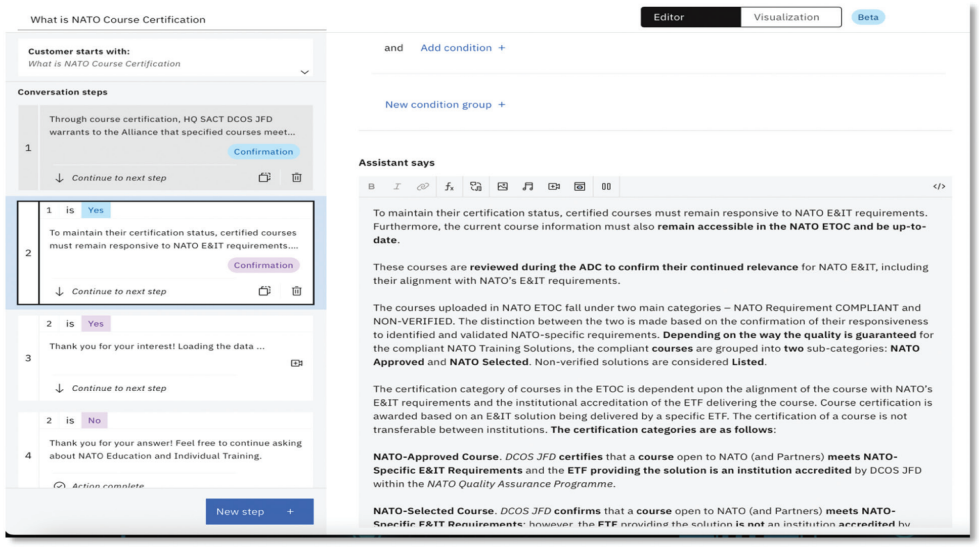

Figure 11 V IBM WatsonX Assistant admin interface view for content creation

for students` interaction (see *Fig. 11*). When designing new content several principles must be taken into consideration.

• *Diversity*. Depending on the insights analyzed in the previous step, this could mean creating a new set of Frequently Asked Questions (FAQs), or, for an enhanced understanding, creating new educational videos to augment the text provided within the answers. The aim is to support various learning and interaction styles.

• *Collaboration*. Subject matter experts (SMEs), instructors, and user experience designers can collaborate closely. By pooling their expertise, the new content created is both accurate and engaging. The IBM Watsonx Assistant platform allows seamless collaborative working for multiple administrators.

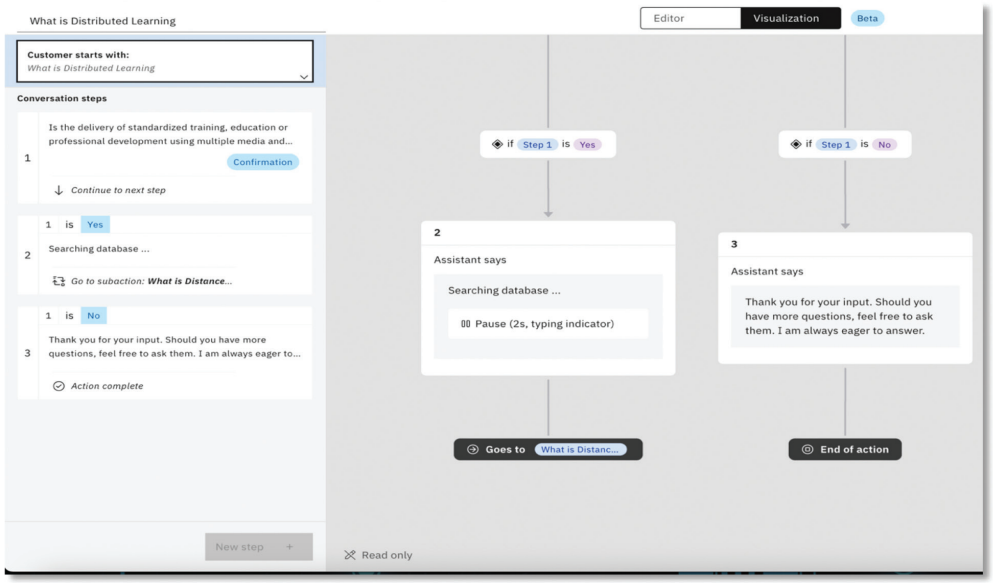

Figure 12 IBM WatsonX Assistant admin interface view for dialog logic flow

• *Interaction*. When creating new content for the chatbot, it is crucial to ensure it is formatted for seamless interaction. This might mean chunking information, adding interactive elements, or even designing content into a more conversational style flow, allowing the student to choose from a multiple-option menu. This principle also supports the microlearning approach (see *Fig. 12*).
• *Quality Assurance*. Every project/product irrespective of its size must aim for consistent quality. In this respect, every piece of new content undergoes rigorous checks. This ensures accuracy, relevance, and clarity, maintaining the high standards our students expect.

Update content and conversational flow. IBM WatsonX Assistant, as an AI conversational chatbot, may sometimes be limited by its level of understanding the intents posed by the students as questions. By recognizing the intent expressed in a student's input, the chatbot can choose the correct dialog flow for responding to it. Therefore, the chatbot will be as good as the logic defined in the back end to retrieve the most relevant information and present it to the student. The chatbot will also need to be trained to identify the desired intent, even if phrased using different words. Multiple utterances indicating the same intent must be provided for accurate detection (see *Fig. 2*). Examples will be used to build a Machine Learning (ML) model that can recognize the same or similar types of utterances and map them to the appropriate intent. As a result, this step should aim to tackle the following aspects:

• *Content synchronization*: This can be achieved by verifying that the new content created in the previous step is integrated seamlessly with other conversational flows and content already stored in the database. This can be translated into actions like updating FAQs, modifying/updating existing dialog flows (see *Fig. 12*), or even replacing outdated content with a fresher version.
• *Algorithms and dialog flow*: The chatbot's ML model is based on its algorithms and defined conversational flows. Gathering additional data and insights allows tweaking and refining these algorithms to boost accuracy, reduce misunderstandings, and ultimately ensure more quality responses for the students. By continuously feeding new data into the chatbot`s ML model, the chatbot evolves, learning from each interaction and becoming progressively smarter.
• *Scalability & flexibility*: The updates performed must not be solely present-oriented. Future goals envisioned for the chatbot must be taken into account, ensuring the chatbot can handle increased loads, newer query types, and more complex interactions, depending on the level of ambition projected.

Test the new version. Testing, in this particular instance, refers to the systematic process of evaluating and verifying the functionality, performance, and effectiveness of the chatbot. Additionally, by testing a new version, the integrity of the new updates is ensured. Before deploying any changes to the wider training audience, a rigorous validation process is essential. This step must be undertaken considering the following aspects:

• *Preliminary testing*: As soon as updates are integrated, preliminary checks are conducted to ensure basic functionalities remain intact. This type of testing should not go into too much detail, as it is solely meant for identifying any immediate and obvious issues that the new updates might have introduced.
• *Feedback integration*: If available, a tester or a team of testers, provide their feedback. It must detail any problems they encountered, as well as areas for improvement, or aspects they found particularly important to be brought into the developer`s/ administrator`s attention.
• *Error handling*: This aspect is dedicated to identifying how the chatbot manages unexpected queries or challenges. If the tests are thorough enough and the feedback report sufficiently detailed, errors should be identified and mentioned inside. The goal is to ensure graceful error handling, minimizing students` frustration for not receiving the expected answer.
• *Regression Testing*: Lastly, one of the most important aspects is where the designated testing team ensures that the new updates have not negatively affected existing functionalities. Equally important, the chatbot must be carefully verified so that the newly integrated data does not introduce adjacent issues that might affect the old content.

Update and publish the new version: The final phase in the process of continuous improvement guarantees that all enhancements and recommendations identified in previous steps are addressed and incorporated into the new version. This marks the end of a development cycle and, at the same time, the beginning of a new one, maintaining the chatbot`s content updated and relevant for the targeted learning audience.

Conclusions

There is an increased need to shift the paradigm of education and training by adopting and exploiting the potential of emerging digital learning technologies. The "Learn-Watch-Ask" (LWA) Training Model, characterized by its innovative approach to the integration of digital tools and adaptive learning techniques, is trying to make its contribution to addressing the complex educational challenges in specialized domains.

The LWA model's success lies in its unique combination of structured online learning, visual aids provided by a YouTube channel, and interactive engagement through a conversational AI chatbot. This multimodal learning approach not only promotes diverse learning preferences but also ensures round-the-clock accessibility and relevance. The implementation of the IBM WatsonX Assistant as the conversational AI component of the model has proven particularly effective, offering consistent and accurate interactions that enhance the quality of the learner's experience.
The adaptability of the LWA model to various specialized domains illustrates its versatility and broad applicability beyond the limits of NATO's QA Course. The

continuous improvement loop implemented for the IBM WatsonX Assistant ensures the model remains dynamic and responsive to the evolving needs of learners.

Finally, the LWA Training Model represents an alternate modern educational methodology, blending traditional learning principles with cutting-edge digital tools. It offers a scalable, flexible, and effective framework that promises not only to enhance the quality of education within a particular NATO topic but also to serve, in the near future, as a valuable and affordable option at hand for the training solutions delivered in various other domains.

References

Bouchey, Bettyjo, Jill Castek and John Thygeson. 2021. "Multimodal Learning." *Innovative Learning Environments in STEM Higher Education* (Research Gate) 35-54. doi:10.1007/978-3-030-58948-6_3.

Ferrara, Emilio. 2023. *Should ChatGPT be Biased? Challenges and Risks of Bias in Large Language Models.* https://doi.org/10.48550/arXiv.2304.03738.

Kooli, Chokri. 2023. "Chatbots in Education and Research: A Critical Examination of Ethical Implications and Solutions." *MDPI* 15 (7): 5614. doi:https://doi.org/10.3390/su15075614.

NATO. 2015. "Bi-SC Education and Individual Training Directive (E&ITD) 075-007." Annex B, B-2.

Palmon, Itai, Craig S. Brown, Alexandra Highet, Alexandra A. Kulick, Meredith E. Barrett, Devon E. Cassidy, Alexandra E. Herman, et al. 2021. "Microlearning and Social Media: A Novel Approach to Video-Based Learning and Surgical Education." *Journal of Graduate Medical Education* (PMC PubMed Central) 13 (3): 323-326. doi:10.4300/JGME-D-20-01562.1.

Raiyn, Jamal. 2016. "The Role of Visual Learning in Improving Students' High-Order Thinking Skills." *Journal of Education and Practice* (IISTE) 7 (24): 115-121. https://files.eric.ed.gov/fulltext/EJ1112894.pdf.

van Geel, Marieke, Trynke Keuning, Kyra Meutstege, Jitske de Vries, Adrie Visscher, Christel Wolterinck, Kim Schildkamp and Cindy Poortman. 2023. "Adapting Teaching to Students' Needs: What Does It Require from Teachers?" *Effective Teaching Around the World* (SpringerLink) 723-736. https://doi.org/10.1007/978-3-031-31678-4_33.

Zhai, Xuesong, Xiaoyan Chu, Ching Sing Chai, Morris Siu Yung Jong, Andreja Istenic, Michael Spector, Jia-Bao Liu, Jing Yuan and Yan Li. 2021. "A Review of Artificial Intelligence (AI) in Education from 2010 to 2020." *Complexity* (Hindawi) 2021: 1-18. https://doi.org/10.1155/2021/8812542.