The Analysis of Earth and Life Sciences Educational Videos in TelmidTice Platform (Morocco): Technical Quality, Pedagogical and Didactic Considerations

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***Abstract*—In recent years, the development of Information and Communication Technologies (ICT) had a considerable impact on the teaching-learning process, both in terms of quantity and quality. Despite the appearance of many innovative teaching resources, video remains the preferred teaching tool for teachers and learners. Currently, this resource medium is widely used in face-to-face, hybrid and distance learning courses due to its numerous advantages in promoting active learning and motivating learners. For this reason, several platforms such as TelmidTice offer free access to educational video clips for learners of all levels and subjects in secondary school in Morocco. This study aims to evaluate the video sequences designed by the Ministry of National Education, Reschool and Sports, and made available online on the official platform of the Ministry called TelmidTice. The analysis concerned a sample of educational videos composed of 10 videos selected among those delivering life and earth science courses. For this purpose, a grid was developed. It comprised several criteria designed for the analysis of the various pedagogical, didactic, visual, and auditory aspects of the educational videos. Findings showed that the majority of the videos analyzed do not meet the different pedagogical and didactic criteria. This also applies to the visual criteria, and the auditory criteria. Based on the results, recommendations have been formulated for the design of high-quality educational videos before being published online and made accessible to learners on distance learning platforms.**

***Keywords*—educational videos, TelmidTice platform, distance learning, pedagogical quality, didactic quality, technical quality**

I. Introduction

Educational tools have evolved due to recent social transformations and technological advancements. Modern technology has brought a variety of new resources that can be used for teaching and learning purposes. Video has become a popular medium, particularly in the education sector. It is frequently used as a teaching aid in the teaching-learning process. Video is a key element in teaching, especially at the university level. It is integrated into traditional courses, serves as a basis for many hybrid courses, and is the dominant medium for new online training programs [1–3], such as Massive Open Online Courses (MOOCs), Small Private Online Courses (SPOCs), YouTube, and Khan Academy. The pedagogical video, combining auditory and visual elements, is an exceptional means of concepts that are often considered abstract and complex in a structured and clear manner [4]. The video represents a technological tool with expressive possibilities that can prove valuable for students, serving as an effective means to promote active learning and stimulate their motivation. Multiple research studies have reported that video, can be a highly effective educational tool [5–12].

Videos capture the learner's attention by stimulating curiosity and providing realistic scenarios for authentic learning. They convey the message better than text or audio or pictures. It has been reported that found that the combined presentation of images and text with learning content facilitated learning more than a presentation by text alone [13, 14]. The combination of image and text allows learners to experience emotions just like real-life situations, making videos more engaging than other instructional media and easily achieving desired learning outcomes [15].

New generations of learners are in constant relationship with screens, so this medium may be more suitable and more familiar to them [16]. In fact, there is a recent growing interest in video among this new generation of learners. While it is certainly not a new tool, its use has increased due to the global social and health situation related to the COVID-19 pandemic that has hit the world in 2020 [17, 18].

Morocco, like other countries in the world, has adopted distance learning as a major alternative to ensure educational continuity during the confinement related to the COVID-19 health crisis. This mode of teaching, aiming at preserving the health and safety of students, teaching staff, and administrative personnel, has allowed learning to continue in a secure environment. Upon the cessation of face-to-face classes, the Ministry of National Education, Preschool, and Sports (MoNE) quickly developed digital resources intended to be broadcast on public TV channels (Attakafia: A Moroccan public television channel created in 2006 with an educational and cultural mission; Tamazight: A Moroccan public channel, established in 2010, aimed at promoting and preserving Amazigh culture; Laayoun: A regional public television channel in Morocco, established in 2004, covering the entire territory of Moroccan Sahara) and uploaded to the official distance learning platform TelmidTice (Platform offering a range of digital services with the aim of providing

academic support to students through videos, course summaries, lessons, and exercises for all subjects and across all grade levels and school cycles).

TelmidTice is an educational portal accessible on the links http://telmidTICE.men.gov.ma and http://soutiensco.men.gov.ma that allows students to access different digital resources including courses, exercises, exams, and corresponding correction. These materials, based mainly on video streaming as a learning tool, are elaborated by teachers under the supervision of educational inspectors according to criteria defined by the ministerial note number 0485/20 published on 10/07/2020 [19]. The developed resources are organized according to subjects, levels, and branches of study. The undertaken measure aimed to strengthen the principle of equal opportunity between students by allowing them to benefit from all courses provided by the platform, specifically support sessions and preparation for the baccalaureate exams.

Videos can play an important role in the learning experiences of online learners [15, 20]. Therefore, it is crucial to ensure that it is of good quality to warrant that learners can learn effectively at a distance. In recent years, the rapid growth of online education has led to increased interest in research on learning through instructional videos with focus on the quality of videos used [21]. For the online courses, especially Massive Open Online Courses (MOOCs), studies have shown that relevant criteria for assessing the quality of instructional videos include pedagogical and didactic aspects such as learning objectives and learning activities [21–24]. Also included are visual aspects such as clarity of images and readability of text, as well as auditory criteria, mainly voice tone and voice dynamics [25].

Based on the available literature, no previous research has addressed the quality of videos on the TelmidTice platform. This gap may be of concern since TelmidTice is considered an official online portal presenting large number of educational resources in video format, elaborated to be used at a distance by learners of all school levels at national level. These educational videos are a valuable tool for distance learning as they can be easily made available to online learners. They can access the videos at their own pace, promoting autonomy in learning and allowing for greater flexibility [26, 27].

The educational videos from the TelmidTice platform can also serve as a complement to classroom sessions in a hybrid learning context. Students can watch the videos to prepare for the subject matter before the face-to-face classes, optimizing class time for more interactive and practical activities. Furthermore, the educational videos from this platform can also be used in the context of flipped classrooms. Students watch the video lessons outside of class hours and use the class time to ask questions, delve into concepts, and participate in more interactive discussions. This promotes student engagement and enhances the assimilation of information [26, 28, 29]. It is therefore crucial and of interest to investigate the pedagogical, didactic, and technical quality of these videos to assess the degree at which these materials are of sufficient quality to ensure effective online learning. Through this study it may be possible to evaluate the quality of the TelmidTice videos and to determine the aspects in which improvements can be made.

II. Research Methods

A. Study Sample

This study used a qualitative method to assess the quality of 10 educational videos covering 4 chapters on genetics (as shown in Table 1) and published on the TelmidTice distance teaching-learning platform. The analyzed sample covers a significant portion of the Life and Earth Sciences curriculum, not only for students in the "Life and Earth Sciences" field but also for those studying "Physics-Chemistry" and "Science and Mathematics-A-," highlighting its importance and relevance in students' academic journeys. Moreover, teaching genetics requires a substantial amount of time beyond what is officially designated. The complexity of genetic concepts necessitates an extended learning period for students to fully grasp the fundamental principles. Beyond its academic significance, genetics ignites students' curiosity and interest due to its fascinating and continuously evolving nature. As it pertains to their own heredity and health, genetics has direct implications for students' daily lives. Through genetics, learners can find answers to questions concerning the inheritance of hereditary traits from parents to offspring, genetic diseases, and the formation of twins, among other topics. Additionally, genetics has led to groundbreaking discoveries in various fields, such as medicine, agriculture, and fundamental research. Hence, it is crucial to deepen the teaching of genetics to educate well-informed learners, preparing them to face present and future scientific and technological challenges.

B. Instrumentation

In order to investigate the quality of the educational videos, an analysis grid (Table 1) was created based on the authors' expertise and on previous studies [1, 25, 30, 31]. The developed grid contained a set of criteria and sub-criteria selected to evaluate the studied videos. The criteria include, in addition to general video data, criteria related to the design and production of effective educational videos. These are grouped into two main areas:

- Area related to didactic and pedagogical quality;
- Area related to the technical quality of the videos.

To estimate the quality and the degree at which the described defined criteria are attained in each video the following scale was adopted: 1: Not at all, 2: partially, 3: perfectly.

C. Validation of Analysis Instrumentation

After the development phase, the analysis tool was validated by a group of experts composed of specialists involved in the field of education, training, and educational technology. These include professors belonging to universities and to Regional Centers for Education and Training Professions (CRMEF, which is an institution for the formation of senior executives, subject to the tutelage of the government authority in charge of national education in Morocco). The tool was then modified according to comments and suggestions made by all the evaluators such as criteria refinement, reduction and/or addition of sub-criteria. In order to ensure its effectiveness and relevance in evaluating educational videos, we conducted a pre-experimentation of the evaluation grid on videos from the TelmidTice platform other than those related to the genetics unit.

Table 1. Educational videos analysis grid

Criteria	Sub-criteria	Area
Title	The title of the video is suitable for the content The subject covers a very specific concept	**Didactic and pedagogical quality**
Learning goals	The learning goals are stated The formulation of the learning goals is correct The learning goals are clear The learning goals are in line with the pedagogical guidelines	
Video content	The content adequately matches the conceptual and methodological objectives set by the official texts The content is scientifically accurate The content is linguistically correct The content does not contain unnecessary repetitions. The content is well-structured	
Content elements and teaching-learning activities	The introduction captures the student's interest The progression of learning activities is logical The activities require active participation from the learner The activities stimulate the learner's motivation and enthusiasm The activities promote learning autonomy The activities require interactivity The activities encourage collaborative learning The documents are clear The explanations are sufficient for understanding The synthesis of the presented elements is good	
Visual quality	The slides are uncluttered The images are clear The displayed text (characters/fonts) is clear The design (colors and graphics) is appealing Visual engagement is present The audio and video are synchronized There are no obstructions	**Technical quality of the video**
Audio quality	The pronunciation is accurate The tone used is appropriate The dynamism of the voice is suitable The sound level is appropriate There is no background noise	

III. Result and Discussion

A. Description of the Videos Analyzed

The characteristics of Videos analyzed are summarized in Table 2, and include title, link, parts treated, and duration. These videos deal with the different chapters of the genetics unit taught to students in the second year of the baccalaureate. This part is common between the three baccalaureate options: Physical Sciences, Life and Earth Sciences and Mathematical Sciences A. The videos covered 4 chapters and are divided as follows:

- Videos 1 and 2 address Chapter 1
- Videos 3, 4 and 5 address Chapter 2
- Video 6 is for Chapter 3
- Videos 7, 8, 9 and 10 are for Chapter 4

Table 2. Description of educational videos

Videos	Details	Contents
Video 1	**Title Link**	Concept of Genetic Information S1 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=11591
	Section Covered	Localization of genetic information Transmission of genetic information from one cell to another Cell cycle Chemical nature of genetic information
	Duration	25:31 min
	Academy	Beni Mellal- Khenifra
Video 2	**Title Link**	Concept of Genetic Information S2 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=11864
	Section Covered	Structure and composition of DNA Concept of karyotype and chromosomes Relationship between chromosome, chromatin, and DNA DNA replication
	Duration	27:28 min
	Academy	Beni Mellal- Khenifra
Video 3	**Title Link**	Expression of Genetic Information S3 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=12807
	Section Covered	Concept of hereditary trait, gene, allele, mutation The relationship between protein and trait The relationship between gene and protein
	Duration	25:36 min
	Academy	Beni Mellal- Khenifra
Video 4	**Title Link**	Expression of Genetic Information S4 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=12776
	Section Covered	Transcription of DNA: • Discovery • Intermediate between nucleus and cytoplasm • Structure of RNA Mechanism of transcription
	Duration	26:35 min
	Academy	Beni Mellal- Khenifra
Video 5	**Title Link**	Expression of Genetic Information S5 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=13111
	Section Covered	Translation of mRNA: • Role of mRNA • Genetic code • Translation actors Steps of translation
	Duration	28:16 min
	Academy	Beni Mellal- Khenifra
Video 6	**Title Link**	Transmission of Genetic Information through Sexual Reproduction https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=13084

	Section Covered	Karyotypes of parent cells of gametes Karyotypes of gametes Phases of meiosis Changes in DNA quantity during meiosis Role of meiosis in allele shuffling (Intrachromosomal and interchromosomal recombination) Fertilization and genetic diversity
	Duration	23 :30 min
	Academy	Beni Mellal- Khenifra
Video 7	**Title Link**	The Statistical Laws of the Transmission of Hereditary Traits in Diploids". S1 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=13215
	Section Covered	Concepts:genotype - phenotype - homozygous - heterozygous Monohybridism: • Cases of complete dominance • Mendel's Laws (Law of Segregation and Law of Independent Assortment) • Test Cross • Case of codominance
	Duration	24 :36 min
	Academy	Beni Mellal- Khenifra
Video 8	**Title Link**	The Statistical Laws of the Transmission of Hereditary Traits in Diploids. S2 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=13298
	Section Covered	Monohybridism: • Case of the genic (single gene) inheritance • Case of the sex-linked gene inheritance
	Duration	26 :07 min
	Academy	Beni Mellal- Khenifra
Video 9	**Title Link**	The Statistical Laws of the Transmission of Hereditary Traits in Diploids. S3 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=14568
	Section Covered	Dihybridism: • Case of two independent genes (independent assortment) Third law of Mendel (Law of Independent Assortment)
	Duration	26 :30 min
	Academy	Beni Mellal- Khenifra
Video 10	**Title Link**	The Statistical Laws of the Transmission of Hereditary Traits in Diploids. S4 https://telmidtice.men.gov.ma/Home/Details?niveau=3A33&id=12959
	Sections Covered	Dihybridism: • Case of two linked genes (genes located on the same chromosome) Linkage map (genetic map)
	Duration	25:18 min
	Academy	Beni Mellal- Khenifra

It is worthy to note that the length of each video is considerably too long, averaging over 24 minutes. In fact, based on feedback from students, and through experimental studies, it has been reported that shorter videos are preferable to longer ones. They were found to be more engaging, with an increase in learning outcomes and influencing learners' decisions to use video in future learning activities [32–36]. Further studies regarding watching sessions in maths and science subjects found that median engagement time was at most 6 minutes, regardless of video length [37]. To address this concern videos can be offered in segments.

B. Pedagogical and Didactic Analysis of the Quality of the Videos

1) Video titles and learning objectives

The title of an instructional video plays a crucial role in learning. It informs learners about the content of the video, attracts their attention and motivates them to watch it by creating interest and curiosity [38]. When instructional videos have relevant and accurate titles, learners can know exactly what will be covered in the video, they will be able to watch them carefully and effectively, resulting a better understanding of their contents with maximum benefit to achieve the learning objectives set. In addition, it is important that a video addresses a specific topic or notion. This allows greater focus with provision of accurate, useful, and meaningful information to learners. Information presented to learners should be structured, and videos should be directly related to the concept [39, 40].

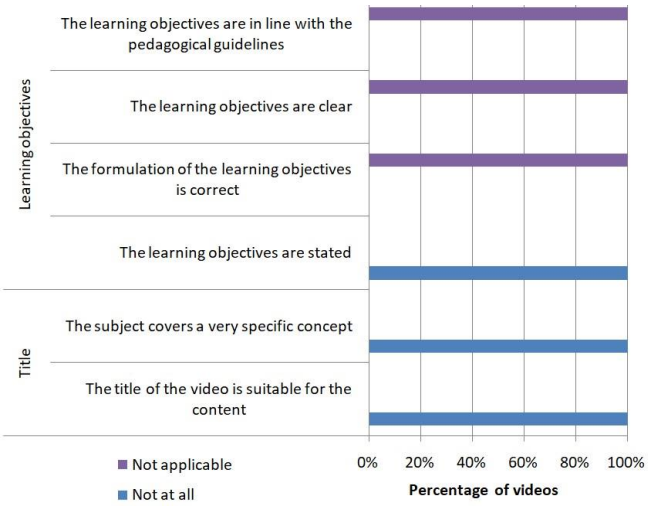


Fig. 1. Results of the analysis of the titles and learning objectives of educational videos.

As shown in Fig. 1, all the titles given to the analyzed videos are not precise, do not perfectly fit their contents, and do not deal with specific notions. They are very general and vague and do not allow learners to know exactly what content each video covers without viewing it completely. This makes finding a part of the course a difficult task. A title such as "DNA Transcription" would have been a more appropriate choice for video 4 entitled "Expression of Genetic Information". Therefore, it is essential and crucial to carefully choose a title appropriate to the content presented, and should provide information about the focus of the video.

It is often taken for granted that communicating content automatically provides information about objectives, yet the same content can have different uses and functions. Explicitly stating objectives is of major importance in the teaching-learning process. According to the Free University of Brussels' report [41], the pedagogical objectives should be clearly defined at the beginning of the video, suggesting that it is important for learners to know what they are watching and why they are watching it. It is also pertinent to explain what is expected of the learner while watching the video. It is considered as a point requiring a particular attention in order to help learners to get involved in the video. Indeed, there must be a match between the content of the video and the stated objectives [4].

The analysis of the different videos showed the complete absence of explicit declaration of objectives in the first moments of the video (100%). On the contrary, in some cases, the teacher simply enumerates the parts of the course that will be covered in the video and do not state the objectives to be achieved (video 5, video 7, video 8, video 9 and video 10). In

other cases, the teacher reserves the first minutes to just state the first part that will be covered in the video (video 2). In some videos (video 3, video 4, video 6), the teacher asks questions allowing to reach the objectives set by official texts. Sometimes these questions are not limited to a single video but concern several videos. By the way of example, in video 1, the questions asked at 01:34 also concern the transmission and expression of genetic information while this video only deals with the first part of the transmission of genetic information. It is therefore important for teachers to take time to formulate clear, relevant and concise learning objectives, with explanation of what is expected from the learner when viewing the video.

Due to the absence of an explicit statement of objectives at the beginning of each video, it was not possible to analyze them in terms of working, clarity and conformity with pedagogical guidance. It has been reported that pedagogy is the key to effective use of digital video, and the way science teachers use the videos can promote an inquiry environment where student ideas are generated and tested [42–44].

2) The content of the educational videos

In this study, the analysis of the quality of the video content consists of assessing the extent to which the content presented by each video is in line with the conceptual and methodological objectives prescribed by the official Life and Earth Sciences texts for upper secondary education [45]. This was made possible through the evaluation of the scientific and linguistic relevance of the presented content, as well as seeking the presence of unnecessary repetitions and clear segmentation in each video.

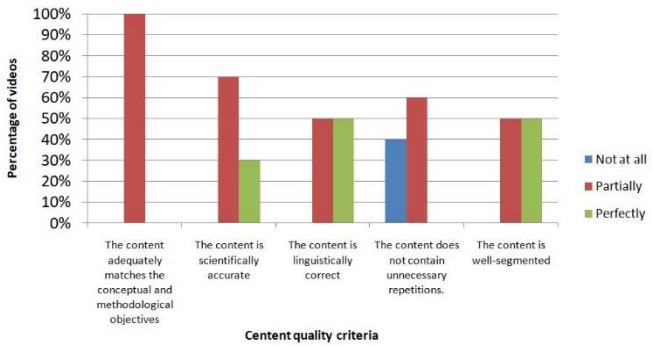


Fig. 2. Content quality analysis of the instructional videos.

According to Fig. 2, the analysis of the videos sample shows that the content of all videos (100%) is only suitable for notional objectives that correspond to knowledge acquisition. In contrast, methodological objectives related to scientific reasoning are generally ignored in all instructional videos.

The scientific accuracy of the content of an online educational video is crucial for its effectiveness as a learning tool. Incorrect or inaccurate information can mislead learners and make it more difficult to understand the data, thus reducing the relevance of the video. The graph in Fig. 2, shows that 30% of the videos are perfectly correct from a scientific point of view, versus 70% of the videos that have some scientific errors. By the way of examples:

In video 1, starting at 14:35, the teacher states that "the chromosomes are attached to the poles by the chromatic or polar fibers which play a role in the arrangement of chromosomes on the equatorial plate." In this statement, there are two errors to be corrected; the first is considering that the chromosomes are attached to the poles by the polar fibers, the second is to talk about the arrangement of chromosomes on the equatorial plate. In fact, it is the chromatic fibers that are attached to the chromosomes, these latter are arranged at the cell's equator during metaphase to form an equatorial plate.

In video 2, there is also an error in the organization of the DNA double helix, which is the cornerstone of all chapters of genetics. Fig. 3 shows that the nitrogenous base for all nucleotides is attached to the 2' carbon of the sugar deoxyribose. Normally for each nucleotide, the nitrogenous base is attached to the 1' carbon and not the 2' [46].

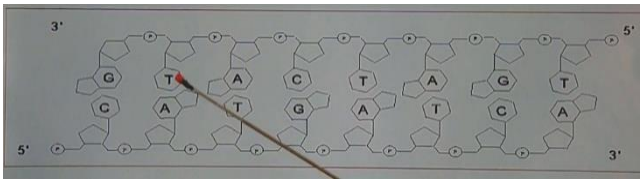


Fig. 3. Screenshot of video 2.

In video 6 (Fig. 4), the following expression was displayed: "identical chromosomes are said to be homologous". This similarity between homologous chromosomes is not 100% correct, it is valid for some characteristics like size, and position of centromeres but it is not correct from an allelic (genetic) point of view.

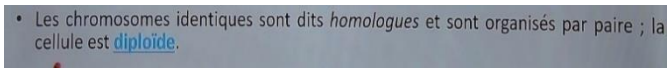


Fig. 4. Screenshot of video 6.

In the same video, the teacher explains saying at 20:13 "fertilization is random, we don't know which gamete will fertilize which egg." In this, the term "egg" is not accurate and should be replaced with "ovum" (female gamete), and there is also missing information about the sex of the gamete (male gamete).

Also, in the same video, the following expression was displayed (Fig. 5): "Chromosomes split (keeping their two chromatids) due to the shortening of the division spindles that drive the centromeres towards one of the poles of the cell". In fact, there are not several division spindles in the cell but only one division spindle per cell; moreover, it is only the chromosome fibers of this spindle that shorten to move the chromosomes during division and not the entire division spindle.

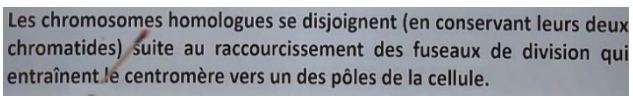


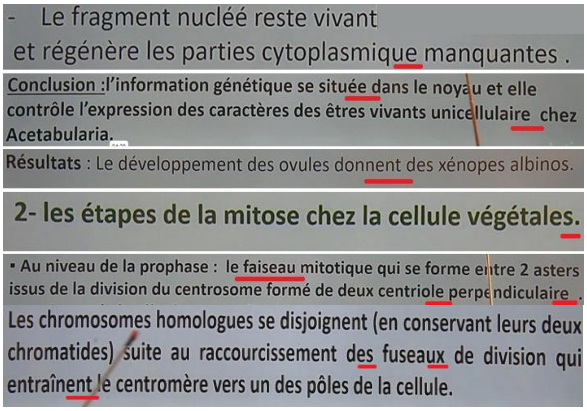
Fig. 5. Screenshot of video 6.

For video 7, specifically, in the section pertaining to the lethal gene, the teacher justified the heterozygosity of the parents due to the appearance of a heterogeneous generation in the offspring resulting from crossbreeding and by invoking the first law of Mendel. Verifying this law requires that the parents in the crossbreeding have opposing phenotypes, whereas in this case, both parents have the same phenotype (yellow-furred mice). Studies reported that content errors and inaccuracies in various scientific aspects of learners'

educational tools may reinforce or support inaccurate conceptions [47].

Regarding linguistic errors, it was observed that half (50%) of the analyzed videos present spelling and grammatical errors that occur at the level of speech and/or writing. By way of examples, videos 1 and 6, contained several mistakes in the text displayed on the screen (Fig. 6).

To remedy to the scientific and linguistic issues related to videos used for teaching learning purposes, there is a requirement to peer-review the videos by linguistic professionals for language matters, professional scientist to ensure the scientific accuracy of the content, and professional educators, to ensure the pedagogical content and usefulness for a classroom environment. This process cans improve the standards of quality, with provision of validity to these educational tools.



Video 1

Video 6

Fig. 6. Screenshots of videos 1 and 6 with spelling and grammatical errors underlined.

The examination of video content quality indicates that 40% of the analyzed videos exhibit no unnecessary repetition, whereas 60% of the videos include such repetition (Fig. 2). These repetitions mostly occurred through the oral presentation of some content, often followed by reading the text specific to the same content for a second time. Unnecessary repetition can make the video boring for learners, who may lose their attention, making the video less engaging. Moreover, repetitions take up a lot of time which makes the video longer and tedious for learners. While repetition can be useful in reinforcing recall, it should be used sparingly and in combination with other techniques to make the instructional video more effective. Moreover, reports proposed that eliminating redundancy enhances the effectiveness of multimedia, including videos [48, 49].

Segmentation involves dividing a video into smaller, more manageable segments or sections. This quality is present in half of the videos analyzed (50%) while it is partially present in the rest of the videos. Segmentation is a criterion of great importance in effective educational videos that involves breaking the video into several parts, usually based on the topics or ideas being discussed [50]. It helps to structure the video and make the content clearer and easier to understand. This makes it easier for students to learn by going straight to the sections they are interested in, rather than having to watch the entire video. Several authors reported on the positive results when animations and videos were segmented, enabling learners to stop and reflect between each segment [8, 51, 52]. Learners can also go back to specific sections of the video to review and reinforce their understanding of the information.

3) Content elements and teaching-learning activities

Fig. 7 shows the results of the analysis of the quality of the content elements and the learning activities, with regard to the captivating introduction at the beginning of the video, the progression of the activities, and their capacity stimulate the learner's motivation, ask for his participation, and encourage his autonomy. This part also aims to analyze the quality of the documents used; the explanations provided to the learners as well as the summary provided at the end of the video.

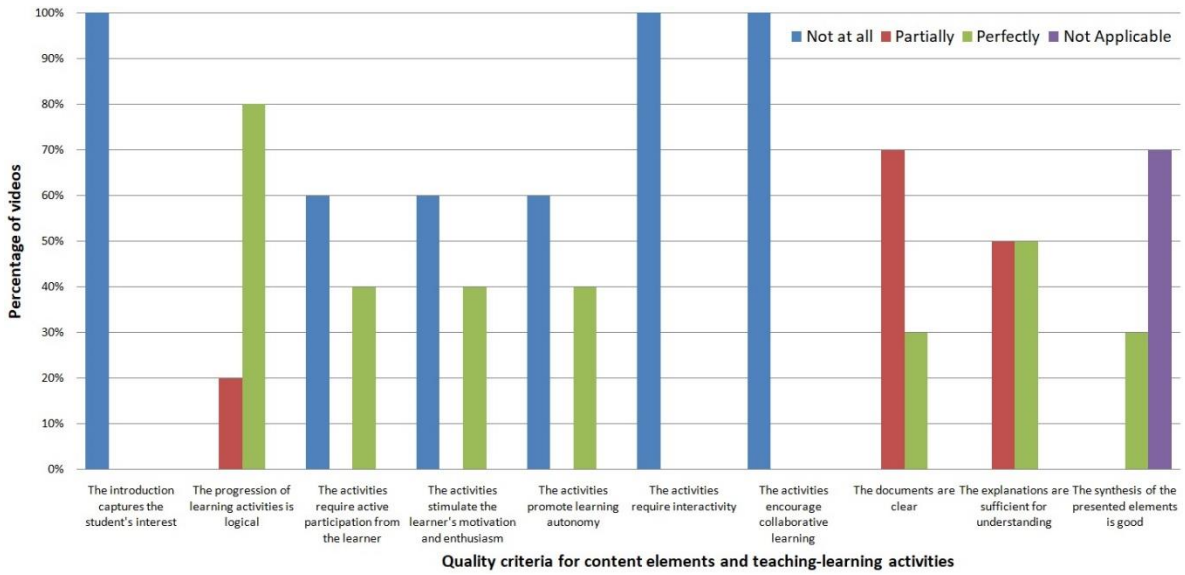


Fig. 7. Analysis of content elements and teaching-learning activities of instructional videos.

A captivating primer is a crucial element to ensure the effectiveness of an instructional video. It captures learners' attention from the beginning of the video, sparking their interest in its content, keeping them engaged throughout the video. According to Fig. 7, it can be seen that all (100%) of the videos analyzed lack a primer that captures students' attention from the first moments of the video. A previous report suggested that a non-segmented video could provide a

captive introductory overview of the topic that would be covered in more detail [8].

The analysis of the different videos revealed that the progression of the learning activities is logical and facilitates the understanding of the content in 80% of the videos. Indeed, the progression of activities in an educational video is a quality criterion of great importance. The activities must be organized in such a way as to achieve the learning objectives defined at the beginning of the video. It is therefore imperative to plan it carefully to ensure that the content is presented in a logical and understandable way for the learners [38].

The present study showed that 40% of the instructional videos include learning activities that stimulate motivation, promote autonomy, and require student participation. In the majority of videos (60% of cases), the teacher explains the content in a traditional way and the students listen passively. Stimulating activities can help maintain students' attention and interest in the video content, which can encourage them to continue learning. In addition, activities that promote autonomy allow students to take charge of their own learning through the provision of opportunities to discover, explore, and apply concepts. Moreover, activities that require student participation can enhance their engagement in the learning process, encouraging them to ask questions and participate in discussions. It can also help them better understand and retain the content [27].

For optimal and effective learning, interactivity is considered a key factor in face-to-face teaching, and even essential in distance learning. The graph in Fig. 7 shows that all videos (100%) do not include interactive activities. Indeed, interaction is a key element in educational videos, it helps to fight against the feeling of isolation. This makes the video more engaging by allowing learners to feel involved, reinforcing their understanding of the content, and enhancing their motivation to learn. Furthermore, it facilitates cognitive engagement, enable active construction of knowledge rather than passive reception, hence affording student reactivity [8, 53, 54].

Based on Fig. 7 not all of the videos include activities that promote collaborative learning. These types of activities allow students to work together, allowing to develop their ability to communicate effectively and solve problems as a team. By providing sufficient explanations, the video allows learners to understand concepts fully and thoroughly, which increases their ability to retain this information and allows them to better problem-solve and think critically. Analysis of the instructional videos showed that explanations were generally sufficient in half of the videos in the study sample, in the remaining videos the explanations were qualified as partially sufficient.

The quality of the materials in an instructional video is an important element in ensuring that learners receive information clearly and accurately. The materials must be of good quality, well-chosen and relevant to the subject matter to help learners reinforce the concepts being taught. In addition, the information contained in the documents must be accurate and verified to avoid errors. The study found that in 30% of the videos, the documents used were perfectly chosen, while in 70% of the videos there were slides that had poor quality documents. Fig. 8 presenting a screenshot of a poor-quality document extracted from video 2.

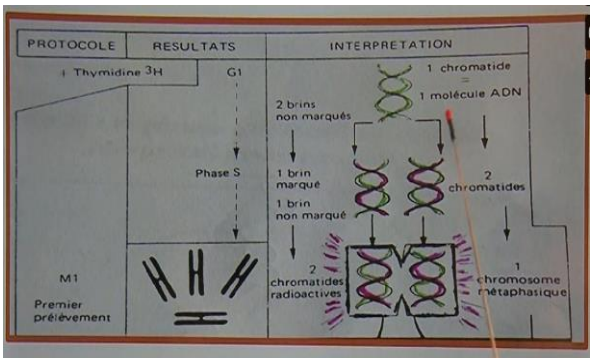


Fig. 8. Example of a poor quality document from the video 2.

The presentation of a summary at the end of the video helps to reinforce the concepts learned, clarify important points, encourage revision, check the learners' understanding and conclude the video effectively [25]. The results show that 70% of the videos do not have this criterion compared to 30% of videos in which the teacher summarizes everything that has been covered in the video. It is important to note that for some videos (video 1, video 2), we noticed the presence of a summary at the end of each part covered, but not at the end of the video.

C. Visual Quality of Instructional Videos

The indicators sought in this section made it possible to measure the visual quality of the instructional videos, which plays a crucial role in capturing the learner's attention and making the video more effective.

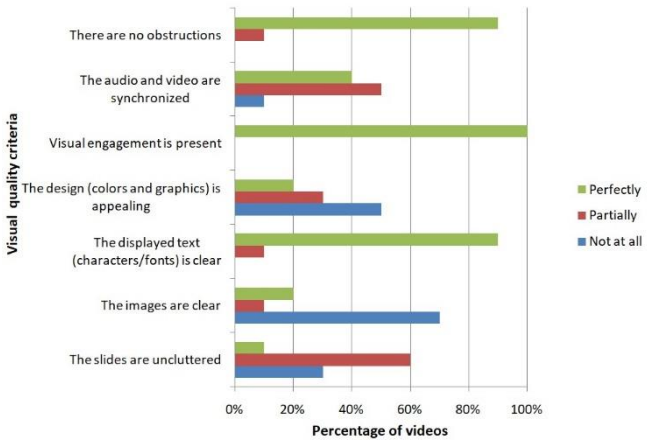


Fig. 9. Visual quality analysis of the instructional videos.

In addition to the teacher's oral presentation, the screen is a display tool and should not be too busy to avoid distracting the learners' attention [55]. Slides that are too crowded can lead to visual overload, making the presentation difficult to follow and understand, especially if they contain too much information or superfluous details. On the contrary, well-structured and lean slides allow learners to focus on the key points of the presentation and retain them more easily. According to Fig. 9, in only one of the 10 videos (10%), the slides are completely filled with content. In contrast, in 60% of the cases, we noticed the presence of a significant number of loaded slides, and in 3 videos (30%) almost all the slides are loaded. To be more efficient, videos should have minimal number of elements in order to keep students' attention allowing noticing and remembering relevant

information [38, 56].

Images can be a powerful tool for reinforcing key points in an educational video. It is important that the images are clear, crisp and have a high enough resolution to avoid blurred images. Images can help make concepts more concrete and easier to understand which can make the video more engaging for learners [38]. The analysis of the investigated videos in our sample, revealed that for the majority of the videos (70%), most of the images are not of good quality, except 2 videos (20%) for which all the images are of high quality, while 10% of videos have images partially clear.

The size of the text in an instructional video is an important consideration to ensure readability and understanding of the information. It is recommended to use a font size that is clear and large enough for the text to be readable on the screen, depending on the resolution of the video [25, 57]. It is also important to ensure sufficient contrast between the text and the background to avoid visual fatigue. The present study shows that the text displayed is clear for the vast majority of the videos analyzed (90%) except for one video (10%) in which some text poses reading problems.

The design of educational videos has a direct impact on comprehension, retention of information, and keeping the attention of learners by making the content more appealing and engaging. In terms of video design, the study showed a lack of appeal for half of the analyzed videos, 30% of the sample had a partial appeal, while 20% had an appealing design. The potential of a video to achieve the pedagogic roles may be compromised if the design of the video is weak. Thus, it has to be done so that it can actively facilitates learning, with a substantial set of pedagogic design [58, 59].

Visual stimulation is used to guide the learner's attention by using techniques such as highlighting, arrows, zoom, or other forms to highlight specific elements. It was found that this criterion was perfectly present in all analyzed educational videos.

In another hand, synchronization between audio and video is crucial in video production. It ensures that the images displayed exactly match the words without a lag. A lag of a few seconds can make the narration incomprehensible [60]. The study findings showed that 1 video (10%) out of the 10 videos analyzed has several moments of desynchronization between audio and video. In 5 instructional videos (50%), this desynchronization occurs partially, while in 4 videos (40%) the synchronization between audio and video is perfect.

Providing words with pictures, images, or other graphics enhances learning relative to materials that include only words. This also applies to videos, which include audio and video components. Similarly, when verbal and visual materials are combined, using audio is more effective than using written text. In addition, the video presented in conjunction with audio narration may be more effective as compared to written text in the video [48]. Moreover, the information can be presented both in auditory and visual way as some students notice better auditory than the others.

On the other hand, the teacher positioning in an instructional video can have an impact on the quality of learning. It is desirable for the teacher to be positioned in such a way that allows to be easily visible and audible to learners. Poor positioning of the teacher in an instructional video can cause visibility issues with the screen, making it difficult for learners to follow the presentations on the screen. Fig. 9 shows that this quality criterion is met in the majority of the analyzed instructional videos, with only one video presenting some moments of obstruction. Regarding the role of the instructor, reports indicated that students appear to engage more with course content as a result of instructor presence in video. However, an appropriate balance is needed to ensure that instructor presence is not distracting while allowing for the inclusion of appropriate social cues (eye gaze, facial expression, vocal tone, body language…) considered as essential to enhance learning outcomes [34, 61–64]. Furthermore, it was reported that students learn better from an instructional video when the on-screen instructor draws graphics on the board while lecturing and explaining the lesson with prompts to engage in summarizing or explaining the [3, 65].

D. Auditory Quality of Instructional Videos

Fig. 10 shows the results of the analysis of the auditory quality of the instructional videos, in terms of pronunciation, intonation, dynamism, voice level and the possible presence of noise disturbing the sound.

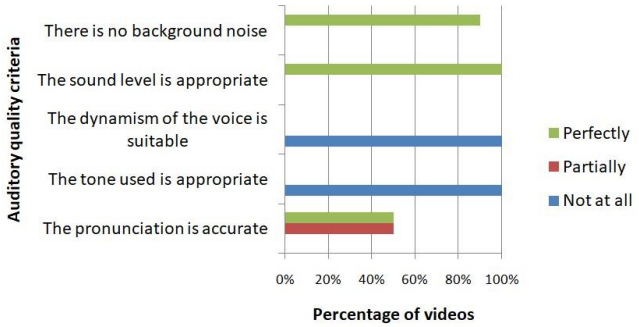


Fig. 10. Auditory quality analysis of the instructional videos.

The pronunciation quality of the presenter in an instructional video is crucial because it can impact the learners' understanding and their ability to learn and develop skills. Poor pronunciation can make words difficult to understand and cause confusion. Our study showed that pronunciation was partially correct in 50% of the instructional videos while it was perfectly correct in the other 50%.

With regards to the tone quality, the study of our video sample revealed that it is adequate in the totality of the analyzed videos (100%). The tone of the voice is a quality criterion in an educational video. It refers to all the acoustic characteristics of a voice, such as volume, speed, etc. A voice that is too loud or too soft, too fast, or too slow, can reduce the effectiveness of learning. Videos where instructors speak fairly fast and with high enthusiasm are more engaging [37]. Also, speaking instructions not too quickly with inclusion of natural breaks allowing the viewer to pause can be beneficial [66].

Intonation is fundamental in an educational video, as it helps to emphasize important information, maintain the learners' interest and create an atmosphere of clarity and attention making the information more accessible and easier to remember [56]. The intonation observed in all the videos analyzed is inadequate (monotone) and can make the video boring and difficult to follow. Therefore, it is crucial for

teachers to be aware of the importance of intonation to ensure effective communication with learners.

The background noise can be a quality criterion in an educational video, as it can make the voice difficult to hear or understand, and it can also distract the attention of the learners, preventing them from fully enjoying the video. It is therefore important to ensure that the video is recorded in a quiet environment. When this is not possible, techniques allowing to eliminate background noise in post-production can be used. This quality criterion is checked in almost all of the analyzed videos (90%).

IV. Conclusion

This research provides an evaluation of the genetic video quality on the TelmidTice platform using an analysis grid. The study findings indicate that the educational videos available on the TelmidTice platform have great potential to be used as an effective teaching and learning tool for life and earth sciences in a remote mode. Nevertheless, their quality must be constantly assessed, modified, and improved to meet the learners' needs. It is important to ensure that the video content is clear, relevant, and suitable for the learners, that the images are of good quality and synchronized with the sound, that the voice is clear, with appropriate intonation and tone, and that background noise is minimized. It is also crucial to check the audio quality of the video to ensure effective understanding.

Through these measures, the TelmidTice platform could meet the requirements of various stakeholders including teachers, learners, and parents. It can therefore serve as an educational resource bank that can play a key role in improving the teaching and learning quality. This may have a major contribution in the academic success of the students, and enhancement of the Moroccan educational system quality, in line with the goals set by the Ministry of National Education, Preschool, and Sports of Morocco.

Regarding the prospects for improving the quality of educational videos in asynchronous distance learning, several avenues can be explored to make video-based distance learning more effective and engaging. These include:

- The creation of interactive educational videos by integrating features such as quizzes, polls, and other interactive elements to involve learners in the learning process.
- The use of artificial intelligence technologies to automatically adapt video content to the needs and preferences of each learner (differentiated learning).
- The use of virtual or augmented reality to provide immersive learning experiences and make concepts more tangible.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Y.R. conducted the research; A.A. and S.S. validated the research; Y.R. and A.O. wrote the original draft; N.B., M.Z. and S.B. reviewed the paper; A.A. and S.S. supervised the research; all authors had approved the final version.

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