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Design Criteria for Instructional Videos

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Abstract: *The use of videos in teaching is becoming more and more widespread. For this purpose, not only existing videos are used, but also exclusive videos are created. There are different types of instructional videos used and created for teaching. It is useful to know which design principles these videos should follow in order to evaluate the quality of existing learning videos and to know the criteria one should consider when creating exclusive instructional videos. Therefore, questions arise as to how these videos should be designed to equally support theory and practice and what educational requirements they should meet for the use in teaching. These questions are answered with the framework of the study in hand that applied the method design-based research, incorporating qualitative and quantitative research methods. Survey instruments were guided interviews with experts, questionnaires for school students and a focus group. Participants in the study were teachers and students from the Vienna University of Teacher Education. The field of application was nutrition and consumer education for teaching students of the middle school. The results are presented in the form of design principles.*

Keywords: *Instructional videos, E-Learning, nutrition and consumer education, Vienna University of Teacher Education.*

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1. INTRODUCTION

The social developments and changes of the last decades, dominated by topics such as globalisation, technologisation or mediatisation, bring new challenges to the system of (higher) education and force the demand for new forms of teaching and learning with, over and in contrast to digital media (Döbeli-Honegger, 2016).

The study presented in this paper contributes to this shift towards digital media in the classroom. The research was conducted in Austria in the context of classes in nutrition and consumer education. This subject is taught at the New Secondary Schools (middle school for pupils aged ten to fourteen) under the name "Ernährung und Haushalt" (EH) (Nutrition and Household). It is divided into a theoretical part dealing with discipline-specific topics and a practical part dealing with food preparation (Buchner, 2008). The teaching of theoretical and practical content is almost always carried out in a face-to-face setting.

So far, there has been no combination of virtual and non-virtual methods in this subject. However, virtual methods such as instructional videos can offer a custom-fit opportunity to enrich teaching. In addition to that, they are available for learners to recall when they want to watch something more often or for repetition and training purposes.

This study aims to find out how instructional videos should be designed to promote theory and practice in the context of lessons for nutrition and consumer education at new secondary schools. In order to achieve this goal, a method was chosen that allows a combination of theory and practice. Design-Based Research is a methodology that is specially applied in educational research and places the development and testing of an intervention at the centre of the research process. The intervention, in this case, was the use of instructional videos. Their use in class was evaluated and optimized in several cycles in order to develop design principles for the creation of instructional videos.

2. LITERATURE REVIEW

Mobile technologies give students a much more comprehensive range of opportunities to play an active role in the design of teaching (Grimus, 2014). Seamless Learning deals with this; its basic idea is that pupils should connect resources outside formal education with those within education (Wong & Looi, 2011). According to Looi et al. (2010, p. 1981), this concept aims to enable learners to learn wherever they are, "The challenge is to enable learners to learn whenever they are curious and seamlessly switch between different contexts, such as

between formal and informal contexts and between individual and social learning, and by extending the social spaces in which learners interact with each other." The term seamless learning was introduced by the American College Personnel Association (ACPA). The first definition of the term was not yet based on technology - the aim was that learners should link their experiences within the classroom with those outside the classroom in order to achieve continuous learning (Wong & Looi, 2011).

Mobile Seamless Learning (MSL, also known as Mobile-Assisted Seamless Learning) is a self-directed learning concept, which represents a combination of mobile and seamless learning. (Wong & Looi, 2011). According to recent studies, almost all young people in Austria have a smartphone, and almost all households have Internet access. Mobile Seamless Learning can, therefore, be a useful concept for sustainable learning (Feierabend, Plankenhor & Rathgeb, 2016).

Ebner, Fößl, Schön and Holzinger (2016) conducted a study between two groups of ten-year-old pupils using a video-based seamless learning model. They present the Design Based Research model as a link between practical learning requirements and educational research. Seamless Learning is presented as a learning setting in a completely open learning environment with the use of mobile devices, where learners can access the learning materials outside of class. The study shows a difference in performance and motivation compared to traditional teaching.

> The design of the teaching approach as an open learning setting gives pupils much freedom in how they go through and use the learning materials (videos). It also provides a well-prepared, pleasant, and helpful learning setting with incentives (stars) such as relatively prompt feedback (each evening). This fits the pupils' needs and pre-requisites. (Ebner et al., 2016, p. 334).

The study provides an example of the possibilities of linking theory and practice in a design-based research model in an educational learning setting.

Instructional videos are audiovisual media to support teaching and that teachers can show within their courses or that they can recommend as supplementary teaching material (Bruder, Grell, Rensing & Wiemeyer, 2015). Instructional videos (short: learning videos) are purposefully searched if something should be explained in a compact form. Instructional videos are used to provide usefully, visualised information on a specific topic (Ebner & Schön, 2013) This means that instructional videos are passively consumed by learners who are searching for them.

Berk (2009, p. 2) mentions 20 advantages of video use in teaching:

> Here are 20 potential outcomes to ponder: 1. Grab students' attention, 2. Focus students' concentration, 3. Generate interest in the class, 4. Create a sense of anticipation, 5. Energize or relax students for learning exercise, 6. Draw on students' imagination, 7. Improve attitudes toward content and learning 8. Build a connection with other students and instructor, 9. Increase the memory of the content, 10. Increase understanding, 11. Foster creativity, 12. Stimulate the flow of ideas, 13. Foster deeper learning, 14. Provide an opportunity for freedom of expression, 15. Serve as a vehicle for collaboration, 16. Inspire and motivate students, 17. Make learning fun, 18. Set an appropriate mood or tone, 19. Decrease anxiety and tension on scary topics, 20. Create memorable visual images.

According to Ebner and Schön (2013), six key parameters play a significant role in the success of instructional learning videos:

1. For the first draft, it is necessary to record why a video is planned and what objectives it is intended to achieve. Also, it should be clarified which videos are already available for the chosen topic and what is technically realizable with the existing skills.
2. Content should be creatively presented and visualized. Video recordings of persons are an excellent way to clarify facts. Distraction should be avoided, but instructional videos should also provide entertainment as this increases attention.
3. A script or video concept must be written. Each instructional video needs a title, an introduction and a conclusion. Each video should be about 2 to 5 minutes long.
4. No videos are allowed to be published without the explicit permission of the filmed persons. Unless it is filmed at public events, when publishing on the Internet, the license terms for the use of the instructional learning videos must be clarified. Likewise, the copyrights should be clarified in advance when using external materials (pictures, music, videos).
5. Concerning technology and design, teaching and learning videos should be designed in such a way that all content is easily visible even in small end devices. Displayed texts should be readable, spoken texts understandable. Background noise should be avoided as much as possible. A collection of lamps for lighting and a tripod are also useful.
6. In addition to the appropriate platform for distribution, precise video description and the clarification of usage rights must be ensured.

3. METHODOLOGY

As part of a research-based approach to learning, students of the Vienna University of Teacher Education dealt with issues relating to macronutrients within the subject of 'Household and Nutrition' and then created short instructional videos. A design-based research design was used to guide and research this process.

The research question comprises one main question and two sub-questions.

Research question: How should instructional videos for nutrition and consumer education at middle schools be designed to promote theory and practice?
The first sub-question: What educational requirements must instructional videos meet for use in the classroom?
The second sub-question: How important is the use of instructional videos in nutrition and consumer education in middle school?

3.1. DESIGN-BASED-RESEARCH

The "Design-Based-Research" method was chosen to implement the concept and design of the instructional videos (Brahm & Jenert, 2014). Design-Based Research (DBR) is a methodology that is mainly applied in pedagogical educational research. The research approach DBR offers the possibility of linking practical and epistemological research (Reinmann, 2005; Design-Based Research Collective, 2003). This pedagogical research approach tries to integrate the target-oriented design of teaching/learning environments with the systematic analysis of learning processes in these learning environments. Characteristics of design-based research are the interconnection of practical and scientific interests, the focus on the design of an intervention, the theoretical anchoring of the research process, the iterative approach and the orientation towards practice (Allert & Richter, 2011). Design-based research aims to address complex problems in teaching and learning contexts through innovative, useful and practical developments (Jahn, 2014).

According to Baumgartner and Payr (1999), the concept of design includes all activities which, within certain framework conditions (here: school kitchen as a place of learning), permit various design options (use of instructional videos in the context of topic-specific teaching in nutrition and consumer education). The inclusion of these results (further development of the videos through the use of different methods) in research is referred to as "design-based research". This means that research design, based on design-oriented media didactics, is required to develop a media-supported learning offering that focuses on a pre-defined educational objective.

The design is significant since the aim of design research is usually an intervention such as a teaching-learning offer or didactic materials for a complex practical problem (the linking of the contents of theory and practice) (Plomp, 2007). This results in the development of design principles with a focus on the creation of instructional videos as well as the integration of the findings into the current scientific discussion.

3.2. PHASES OF THE IMPLEMENTATION

This study is based on the recommendation of Jahn (2014), who uses four phases for the implementation of the Design-Based-Research approach.

Phase 1 - Problem definition: Analysis of the initial situation and development of design guidelines

In the first phase, the researcher explains his motivation and the research question for the design. Also, underlying conditions are clarified and described. The framework conditions for this study are teaching kitchen, inventory and teaching time. The learning objectives are the curriculum, the frame of reference and the underlying decree on the teaching principle of economic and consumer education. The target group is characterized by year of study, group composition and individual needs. The content is consumer education with the topic "advertising", and the media used are instructional videos.

Phase 2 - Design phase: Development of a prototype

Phase two describes the conception of the prototype based on the developed design guidelines. For the development of the design principles, teachers who are experts in this field were interviewed. In this phase, the software for the creation of the instructional videos was selected. The videos were produced and published under legal license conditions. Then the prototype of the videos was introduced in the lessons for nutrition and household. Phase two will be completed by the preparation of the questionnaire for the evaluation by the students.

Phase 3 - prototype phase: cycles of testing, evaluation, and modification of the design

In the third phase of design-based research, the results of the questionnaires completed by the students were analysed, evaluated and visualized. A focus group discussion with students of the Vienna University of Teacher Education will also be conducted and evaluated.

Phase 4 - Evaluation and reflection phase: Reporting

Phase four first summarizes the findings from the previous phases (Jahn, 2014). This study deals with the implications of the findings to generate design principles.

3.3. TRIANGULATION

In order to answer the research question, the research strategy of triangulation is used alongside the Design Based Research approach. This means that different population groups (teacher and students) are involved in the research process (Flick, 2012), semi-structured interviews (teachers), questionnaires (pupils) and a focus group discussion (students) are used.

3.3.1. TEACHERS

Five teachers from the fields of nutrition and consumer education (they teach at various universities in Germany, Austria, and Switzerland) and media education (teachers at the Vienna University of Education) were interviewed in order to be able to assess this central issue - the design of instructional videos - from different perspectives. The main question was "What is essential when designing videos for teaching? ". Concerning the construction of the prototype, the interviews are considered and included in phase two in the form of design guidelines (Jahn, 2014).

The five university teachers interviewed are all working in the training of teachers in consumer education. Three of them work at the University College of Teacher Education in Vienna and Linz. A person in Germany at the University of Education Schwäbisch Gmünd in Baden-Württemberg/Germany in the secondary education and another one on at the University of Applied Sciences Northwestern Switzerland.

3.3.2. PUPILS

In the second phase, the prototype was conceived, designed and implemented based on the design guidelines. The topic of the four instructional videos was "Why do we sometimes buy what we do not want?" (Leitner & Schuh, 2014). One video has the additional purpose of creating a mobile seamless learning scenario in addition to the classroom activities. Mobile seamless learning (also known as mobile-assisted seamless learning) is a self-directed learning concept that combines mobile and continuous learning (Wong & Looi, 2011). The use of smartphones to support the learning scenario is essential for this work. The lesson aims to sensitise students to the advertising they are confronted with in their everyday world. The discussion of the topic will not end after the unit but will be continued seamlessly via a smartphone in the everyday world. In this

video, the pupils are asked to photograph an advertisement - regardless of the medium used - with their mobile phone and to e-mail this photo to the teacher. In one or two sentences, the reason why this particular advertisement is liked and recorded is given. The teacher collects the pictures and shows them to the class in order to initiate a critical introductory discussion (advertising media, children that as advertising media, "sex sells" etc.).

The four videos will be shown in class in the next unit, and the students will evaluate them in the form of a fully structured questionnaire using mainly closed questions (Ebner & Schön, 2013) based on the Austrian school grading system (with the grades one to five and one being the best grade). The areas evaluated include:

- Content: actor, location, realistic action, comprehensibility of the content, speech rate, music, comprehensibility of the set tasks, entertainment value
- Duration of the video
- Image: text, sharpness, camera work, illumination, image editing
- Sound: Sound quality, music quality, ambient noise
- Technique: QR-code to link to the videos (only used for prototype)
- Platform: selected video platform and its design

The questionnaires of the students were analysed in phase 3, quantitatively evaluated and visualised using descriptive statistics (Fahrmeir, Künstler, Pigeot & Tutz, 2007) and form the fundamental basis for the modification of the instructional videos.

24 pupils evaluated the instructional videos in different development cycles by using questionnaires designed according to qualitative research aspects. All participants came from the second classes of the practical secondary school, which is associated with the University College of Teacher Education Vienna. Within the group, one subgroup was chosen for the pre-test and the second subgroup for the initial test. The pre-test was conducted one week before the initial test.

3.3.3. FOCUS GROUP DISCUSSION WITH STUDENTS

In the process of modifying the prototype, a focus group discussion was held with five students of the course of studies "Household Economics and Nutrition" in the teacher training course "Secondary General Education" of the University College of Teacher Education Vienna in order to be able to consider another group in the re-design. Following Döring, Bortz and Pöschl (2016), this process is roughly divided into four phases (planning - implementation - documentation - evaluation), whereby the focus is always on interviewing the group rather than the individuals. It must be surveyed whether and why modifications should be carried out in the original videos.

The videos were modified based on the results of the students' questionnaires and the qualitative content analysis, according to Mayring (2016) of the focus group discussion. The results for the original videos were as follows.
Video 1: For the first video of the prototype, some minor technical changes are planned. With the Camtasia tool in use (Cress, 2015), it is possible to divide the tracks into sound and video and reduce background noise by setting audio points. No modifications to the content are necessary, as the task is classified as short and concise.

Video 2: The second video requires a more precise design of the screencast in the middle section. A blank start screen and the positioning of a callout are used to reduce this point of criticism, which comes equally from the students and the focus group. Furthermore, the opening and closing sequences are tightened as if stimulated, so that the video is 25 seconds shorter due to the modification.
Video 3: The implementation of a practical sequence is the focus. Due to the disturbing background noise, all parts of the prototype video are re-recorded. The practical sequence of the food creation is included in the form of a tutorial, whereby this step-by-step guide is integrated at three times the clip speed due to the desired short sequences. The time frame of the video is extended to a total of three minutes and 31 seconds.

Video 4: Due to the poorly recorded sound, all Video 4 sequences are filmed again at a different location. Furthermore, the focus group criticism about the confusing name "Werbung kritisch betrachtet" (Critically Viewed Advertising) has to be addressed, and the title changed so that the focus is on the students' perspective as they observe their surroundings. The transmission of the assignment for the homework is now at the centre of attention.
The four prototype videos are modified according to the summarized points of view from questionnaires and focus group discussion and are then again exposed to the evaluation by questionnaires (iteration of the cycle), whereby the research design is fulfilled. After calculating the average marks given by the students to the videos, it can be seen that there is a significant increase in the quality of the videos.

4. RESULTS

Based on the methodical approach, the research questions can be answered. The main research question was "How should instructional videos for nutrition and consumer education at middle schools be designed to promote theory and practice?"

In order to promote theory and practice in nutrition and consumer education, instructional videos should include real-life scenarios that allow students to connect knowledge with practice. The locations selected in the instructional videos (teaching kitchen, library, grocery store not far from the practical secondary school, settlement) led to a high level of identification among the pupils and a positive assessment of them in the questionnaires. The design of the videos is successful if the theoretical contents show and prepare the understanding of the possible connections.

To answer the research question, design principles were also identified. The design principles are based on the results of the research conducted. In the following, the generated design principles for the creation of instructional videos are further embedded in the general discussion.

4.1. SCENARIOS AND PLATFORMS

Videos should always be the better alternative for knowledge transfer: If instructional videos are used in class, both sides (teachers and learners) have hopes and expectations. On the part of the teachers, this requires a general clarifying whether other (and possibly less complicated) methods are more purposeful with the desired learning goals.

Tutorials are often watched by students and should be combined with theoretical content: According to Feierabend, Plankhofer, and Rathgeb (2016), more than a third of 12 to 19-year-olds receive online tutorials daily or several times a week, which generally indicates a high level of acceptance for this form of video. In the sense of an appropriate division of theoretical and practical content for the designed instructional videos, it is clear upfront not to produce videos that merely show a sequence of practical steps in the preparation of a menu. Thus, in the concrete case in video 3 within the modification, the workplace setting (theory) with the creation of a simple dish (practice) is linked to a tutorial and evaluated significantly better than the prototype (only a theoretical input).

Videos are to be made available on a platform known to the pupils: The literature research indicates that a platform that is as well-known and popular as possible should be chosen for the distribution of instructional videos. The best place for videos is where they can be found by potential users (Ebner & Schön, 2013). The evaluated questionnaires confirmed the high acceptance (average grade 1.67) of the selected platform YouTube among the students.
Nutritional and consumer education offers a reasonable basis for the use of mobile seamless learning scenarios due to its theoretical and practical references: It should be noted that smartphones are now part of the necessary equipment of

children and young people. All students in both the prototype and modification groups have this device. The linking of resources within and outside the classroom (Fößl, 2014), which is the aim of the scenario, is intended in the lesson topic "Why do we sometimes buy what we do not want" and transmitted as a homework exercise.

4.2. IDENTIFICATION

The inclusion of students in videos proves to be highly motivating due to their identification with the protagonists: according to Valentin (2015), involvement promotes the students' in-depth examination of the subject matter, since they become teachers. The interviewed practitioners and teachers agree that videos produced by peers in the peer group better convey the desired content in the course of knowledge transfer.

4.3. DESIGN AND TECHNOLOGY

Instructional videos should be kept short, but not too short: According to Ebner and Schön (2013), videos for learning purposes should have a length of two to five minutes. This information is confirmed by the evaluation of the questionnaires. The teaching and learning video number 1 with the title "Werberätsel" (advertising puzzle) did indeed allow for a high level of identification with the actors due to the peers involved in the video's production. However, both the prototype group and the modification group classified the video as far too short, with a duration of 45 seconds, and the "duration of the video" factor was therefore rated below average.

In addition to the identified design principles, there is also a clear answer to the first sub-question "What educational requirements do instructional videos have to meet for use in the classroom?"

Concerning a design-oriented media didactics, Kerres, Ojstresek & Stratmann (2011) recommend considering the educational environment of video usage. The results of the interviews also showed a high demand for the fitting of the instructional videos to their learning environment. Furthermore, the evaluation of the five interviews and the focus group discussion showed that simple production - preferably involving the pupils - is preferable to elaborately designed instructional learning videos. Similarly, the change in the lead media suggested by Döbeli-Honegger (2016) was confirmed in the interviews and should, therefore, also be taken into consideration in the didactic concept. The results of the interviews and the focus group discussion show that the distribution of the videos must be communicated and taken into account in the

conception. The platform and the link are to be defined in advance, as is the licensing model for the produced instructional videos.

Second sub-question: How important is the use of instructional videos in nutrition and consumer education in the in middle school? According to the results of the semi-structured interviews, the importance of video use in nutrition and consumer education in the German-speaking countries (Austria, Germany, Switzerland) has increased. The reason for this is the permanently growing number of media resources that teachers consider to be serious. In addition to the theoretical seminars, videos are mainly used for reflective school practice. Again, the technical paradigm shift is indicated as an advantage: A smartphone for the recording is enough for the teacher to record the interaction between pupils and students.

5. DISCUSSION

The advantages of the present design are the design and research in the field, as well as the feedback to modify the prototype. This allows improvement of the prototype using incremental modification. Although the technical possibilities of any video production (especially with smartphones) are now quite easy to handle; more attention must be paid to the writing of the video concept (content, scene description, text, and duration).

The results of the research show a high degree of readiness, especially on the part of learners, not only to deal with instructional videos as passive consumers but also as participants themselves. Therefore, the results of this work should motivate students to actively involve themselves in the design of instructional videos promoting theoretical and practical content. The method offers teachers and learners the possibility of a more in-depth thematic discussion. The use of videos can present theoretical knowledge in a condensed form, but therefore, always requires the moderating role of the teacher to lead to the learning goals.

The results show that the distribution of the videos must be carefully considered and communicated. In addition to the platform and link, considerations must also be made regarding the release modalities of the produced instructional videos and the necessary conditions for their use. It has also been confirmed that smartphones are suitable for integrating learners into the teaching process as active knowledge designers. However, mobile seamless learning scenarios can only be initiated if the work order can be retraced step-by-step by the students.

It can, therefore, be stated that it makes sense to orient the conception and design of instructional videos to the environment of the pupils. In order to promote theory and practice in nutrition and consumer education, instructional videos should contain realistic scenarios that allow the students to apply their theoretical knowledge practically in their everyday world. The starting point for this study is the rigid separation of theory and practice in nutrition and consumer education at new middle schools in Austria. No digital media have been used in the past. The transfer of knowledge only took place in face-to-face settings, and there was no mix of virtual and non-virtual methods. This situation can be found in many pedagogical environments. The goal of this study was to create improvement by adding a virtual dimension and providing instructional videos. Therefore, the aim of this study could also apply to many other learning environments. For this reason, the design principles developed in this work for instructional videos can also be used for other subjects.

For this work, a smartphone supported scenario was chosen. In the subject of nutrition and household, a distinct scenario is a connection between a lesson and the real world of consumption with, which the pupils are confronted daily. This practical approach cannot be chosen for all subjects. Nevertheless, the use of smartphones represents a variant of the use of digital media for teaching and learning purposes which are adaptable in different forms for all disciplines. Instructional videos can, therefore, also be placed in the broader context of e-learning (Kerres, 2012).

This study also illustrates that the Design Based Research model can be an appropriate method to research technologisation in education. "The reality of educational technology research is that isolated researchers primarily conduct one-off quasi-experimental studies rarely linked to a robust research agenda, much less concerned with any relationship to practice." (Reeves, 2006). The aspect of technologisation in the field of educational practice must be included in the research field. If that does not happen, there will be theory-practice complications.

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