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Using Hypervideo to support undergraduate students' reflection on work practices: a qualitative study

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Abstract

According to several exploratory studies, the HyperVideo seems to be particularly useful in highlighting the existing connections between the school-based and the work-based contexts, between authentic work situations and theoretical underpinnings. This tool and its features, in particular, the video annotation, seems to constitute an instrument which facilitates the students' reflection on work-practices. Even though several researchers have already studied the efficacy of HyperVideo, studies concerning the qualitative differences between a reflection process activated with or without its use are still missing. Therefore, the present contribution is focused on the reflective processes activated by two groups of students engaged in a higher education course while they carry out a reflective activity on work practices using the HyperVideo or not. The aim is to investigate wether the HyperVideo can be useful for students to foster the connection between theoretical concepts and work practices. Through multi-step qualitative analysis which combined Thematic Qualitative Text Analysis and Grounded Theory, a sample of reflective reports drafted by a group of students who employed HiperVideo to make a video-interview on a work-practice and to reflect on it (Group A) was compared with a sample of reflective reports drafted by a group who did not use it to complete the same task (Group B).
The results emerging from the comparison of the coding frequencies between the two groups show that HyperVideo can support the reflective processes of students, better connecting theory and professional practice.

Keywords: Hypervideo, Video annotation, Reflective activities, Crossing boundaries, Educational technologies

Introduction

Since the turn of the century, the world economy has constantly been in flux because of globalization and the rapid evolution of technology. In order to meet emerging challenges, policymakers have consistently tried to innovate their respective educational systems in order to effectively face and keep up with the demands of the labor market (Paplova, 2009). For example, the European Union (EU) introduced the Lifelong Learning program in 2006, establishing a common framework of key competencies that member States had to aspire to in order to try and close the gap between educational and work contexts (European Council, 2006). Despite the educational reforms led by

this intervention, the issue is still open. Indeed, the EU recently proposed a renewal effort to address this gap through a new set of recommendations on key competencies for Lifelong Learning (European Commission, 2018). The need to connect educational and work contexts is not new in the field of educational research. A long tradition exists to study how such contexts can interact each other (e.g. Ludvigsen, Lund, Rasmussen, & Säljö, 2011; Stenström & Tynjälä, 2009; Tuomi-Gröhn & Engeström, 2003). Several pedagogical models similarly emphasize the need of a stronger articulation among learning locations and propose ways to realize it: we cite here the *expansive learning model* (Fuller & Unwin, 2003), the *connective model* (Griffiths & Guile, 2003; Guile & Griffiths, 2001), the *integrative pedadogics model* (Tynjälä, 2005, 2008, 2009), and the *hybrid curriculum model* (Zitter, Hoeve, & de Bruijn, 2016). The same perspective is also assumed when studying the knowledge inherent in teachers' work experience in order to make it available for in-training teachers (Tacconi, 2011; Tacconi & Gomez, 2010; Tacconi & Hunde, 2017; Mortari, 2010).

Advocated across these methods, two theoretical concepts that have a central role in describing potential ways for closing the gap between different learning contexts are *boundary crossing*, and *boundary objects.* The concept of "boundary crossing", introduced by Suchman (1994) and refined by Engeström, Engeström, and Kärkkäinen (1995), denotes how an expert worker or a practitioner may need to combine and negotiate elements belonging to different contexts (e.g. routinely workplace, past learning situations, etc.) when s/he needs to challenge new and/or unfamiliar hybrid situations. An unfamiliar hybrid situation occurs when the characteristic conditions of different contexts occur at the same time with novel combinations. The concept of *boundary crossing* bases on that of boundary objects (Star & Griesemer, 1989). "*Boundary objects […] both inhabit* [these] *intersecting social worlds […] and satisfy the informational requirements of each of them […] maintainin*[ing] *a common identity across the sites*" (p. 393). The results of a literature review drafted by Akkerman & Bakker, 2011, through which they examined 181 papers to better understand the learning potential of boundaries, reveals reflection to be one of the four potential dialogical learning mechanisms taking place at the boundaries, together with identification, coordination and transformation. In particular, reflection "is about expanding one's perspectives on the practices" (Akkerman & Bakker, 2011, p. 150).

Reflection, technologies and the Efrahrraum model

The relevance of reflection for better articulating the distances between different learning contexts has been enhanced also by more recent studies, which are not included in the review cited above (e.g. Perini, 2017; Bronkhorst & Akkerman, 2016; Schwendimann et al., 2015). According to the conclusion of an ethnographic study conducted into the Vocational Education and Training (VET) healthcare context, the "reflective processes take place within a range of settings, contacts and through activities, many of which are initiated and enacted by the [participants] themselves" (Wegener, 2013, p. 471). The reflection process is a recurring element in several experiential learning theories. It assumes different roles, as it can be seen in the following illustrative examples: a) according to the Dewey's (1933) experiential learning theories, the reflective thought allows to verify the foundations of beliefs, and the validity of the routinely practices, as

well as the knowledge on which they are based; b) the four-stage experiential learning model by Kolb (1984), provides for a reflective observation phase, between the concrete experience and the abstract conceptualization phases; c) according to Schön's (1987) view on the nature of the reflective practices, reflection allows practitioners to learn from unexpected outcomes and from events that come out of the routinely actions, activating the attention and creating a prerequisite for self-learning which takes place through reflection. These and many other theoretical frameworks (e.g., Boud, Keogh, & Walker, 1985; Engeström, 1987; Jarvis, 2009; Moon, 1999) define the role of reflection in learning processes, but, just taking a look at the encyclopedic definition attributed to reflection it is possible to understand its role in the learning processes related to work and to the skills development:

> "Reflection plays an important role in experiential learning, both cognitively and metacognitively. It has been widely discussed in the literature as an important approach for promoting learning and higher order thinking skills, developing professional practices, and facilitating and structuring learning through experiences" (Looi & Wu, 2015, p. 610)

Technology is often identified in the literature as a means to support reflection and then able to foster the "bridging function" between the working and school context, because technologies "can serve many roles to support work-based learning" (Margaryan, 2008, p. 17). In this framework, the "Efrahrraum" is a pedagogical model (Schwendimann et al., 2015), consisting "*of technology-enhanced spaces that facilitate conversations between work and school [...] context in iterative loops*" (p. 373). In the Erfahrraum, the boundary-crossing between the contexts is allowed by a scaffolded space for reflection on experiences. In fact, the name of the model is the result of the combination of the German terms 'Erfahrung' (experience) and 'Raum' (space). Conceived to be compliant with dual vocational education, and then to favor learning across contexts, the model is grounded on experiential learning; it gives technologies a special role to create a specific "space" sustaining a reflective process that allows real experiences to become knowledge (Schwendimann et al., 2015). This model confirms then the role of technologies as boundary objects, given that they "*could serve as bridges between the school and the workplace as well as between the actors of these different locations"* (Schwendimann et al., 2015, p. 371). Furthermore, it highlights reflection as a technology-scaffolded activity able to turn experiences into knowledge, without restrictions about the types of technology used for implementation. As anticipated, this model, like many of the studies concerning its bridging activity, has been developed in and for the VET context. Vocational education is a privileged location for studying this topic, especially within states that provide a dual-system (e.g. Germany, Switzerland, Austria, Denmark etc.) which allows students (apprentices) to carry out the curricular activities alternating in its different learning contexts: in the VET school (in the classroom) and in the workplace (working for a company) (Cattaneo & Aprea, 2018).

The Hypervideo and video annotation

According to several exploratory studies conducted within - but not only - the Swiss dual-system, the HyperVideo (HV) seems to be particularly effective in

highlighting connections between classroom and work context, between authentic work situations and theoretical subjects (Cattaneo, Nguyen, Sauli, & Aprea, 2015; Cattaneo & Nguyen, 2016; Cattaneo & Sauli, 2017; Cattaneo, van der Meij, Aprea, Sauli, & Zahn, 2018; Sauli, Cattaneo, & van der Meij, 2018). Moreover, as claimed by Cattaneo & Aprea (2018a) and Schwendimann et al. (2015), it seems particularly suitable for implementing the Efrahrraum model. In 2018 Sauli and colleagues published a literature review which aimed at highlighting the concept and use of HV. The authors drawn the characteristics which distinguish the "classic" video and the HV, splitting them into two groups: 1) the fundamental features allow a non-linear video navigation (e.g. through segmentation or visual tables of content), advanced control features and the possibility to link or include additional material to it (e.g. documents, other videos, descriptions etc.); 2) the optional features allow to insert individual or collaborative video annotation and/or generate manual or automated feedback (Sauli et al., 2018). The second features' group in particular "*allow reflection about the contents and deeper understanding, which is an important aspect of learning with videos*" (Sauli et al., 2018, p. 126). Above all, according to several studies summarized by Cattaneo and Boldrini (2016), "*Video annotation facilitates individual reflection on practices, thereby supporting ex-post monitoring and evaluating processes, as well as anticipatory ones* (Cattaneo, Nguyen, Sauli, & Aprea, 2015, p. 41)". As reported above, the efficacy of video annotation has already been studied by several researchers (e.g. Colasante, Kimpton, & Hallam, 2014; Rich & Hannafin, 2009). However, to the best of our knowledge, studies about the qualitative differences between a reflection process activated with and without the use of video annotation still require investigation. Furthermore, the use of HV should also be examined out of the VET context, in order to foster the connection between different learning location, workplace and school in particular.

Research aims and questions

It is thought that having more information about the qualitative features of the reflective process activated by the video annotation could support teachers and trainers - especially those in VET - in teaching design, because, in order to obtain an effective learning process support, technologies need to be adapted and contextualized depending on the learning context, as remarked by Hattie's metanalysis (Hattie, 2009). Therefore, the present study is focused on the reflective processes activated by the students while carrying out a reflective activity on self-made video interviews using the video annotation tool. This study aims to verify whether the use of this innovative teaching tool in a VET-oriented university context can stimulate learning processes that encourage reflection on working practices. So, the research question that guided the present study is the following: Does the use of the video annotation, a feature of the HV, allow the students to activate a qualitatively different reflective practice compared to the reflective practice activated without the support of this technology? Or better yet, how can the HV be useful for VET teachers and training operators to foster a connection between theoretical concepts and work practices? This study represents the first, exploratory, phase of a wider

research project aimed at discovering the potential of video-related technologies in VET-teacher education.

Methods

In order to answer the proposed question, given its descriptive nature, a Thematic Qualitative Text Analysis (TQTA) was conducted, because "thematic analysis is primarily a descriptive strategy that facilitates the search for patterns of experience within a qualitative data set" (Ayres, 2008, p. 867). Specifically, the analysis procedure for TQTA proposed by Kuckartz (2014) was employed. The choice fell upon Kuckartz's proposal because, unlike the classic version of TQTA (Ayres, 2008), it lends itself to a data-driven approach. The analysis was carried out in two macro-steps: in the first step a codebook was drafted on the basis of the category system that emerged by analyzing a random sample of reflective reports in accordance with the Grounded Theory (GT) approach (Glaser, Strauss, & Strutzel, 1968); in the second step a larger sample of texts was codified through the coding scheme laid out in the codebook. After the analysis process, the coding frequency (in terms of number of words) of the texts belonging to the students who used the annotation tool was compared with those of the students who did not receive any indications regarding video annotation tools for carrying out the assignment. To this end, descriptive statistics, correlational analysis and T-test were employed. The next sections report detail on the data collection and data analysis processes.

Context and participants of the study

The context in which the present study took place is the bachelor course "Educational Sciences in Organizations" held at the University of Verona, during the academic years 2015/2016 and 2016/2017. Specifically, the study-setting is the module titled "Training didactics" which is scheduled for the first year of the course outlined above. The primary reason for this choice was that this course eventually gave to the students the opportunity to operate in the VET sector. Furthermore, the main objective of the module is to improve the course participants' knowledge and competencies by reducing the gap between the students and professional practices, in order to make them capable of conceptualizing and designing appropriate instructional activities in accordance with the specific learning situations offered by the relevant work practices and the training courses linked to work contexts. Therefore, the training activities foreseen in the module have been chosen and designed in order to develop the students' skills in work-practice analysis, i.e., to achieve a deep understanding of the practices' crucial characteristics through a reflective approach, which in turn directs them in putting into words the new acquired knowledge (Tacconi, 2015). Both in the academic years 2015/2016 and 2016/2017, the final exam for the module was structured in three parts: 1) written exam, 2) oral exam, 3) project work completion. Each part of the examination is evaluated on its own merits by the teacher: the final grade of the module is made up of the sum of the grades pertaining of each section. The third part of the exam gave the students two options (between which they could choose) to be completed by

the end of the semester out of the course timetable. One option asked students a reflective report on a free-choice' book. The other option, which is the subject of the present research, asked the students to a) make a video-interview on a work practice (a professional activity) and, b) draft a reflective report on the content of this video and the thought process put in place during the video making. The students could choose the interviewee (whatever kind of professional), the work practice and, where to shoot the video (usually at the workplace of the interviewee). They also had to get the video equipment autonomously. The assignment described above had different rules of implementation in the two academic years: the students of in the academic year 2015/2016 (*Group A*) had to make the video-interview and write the reflective report without receiving restrictions or suggestions; the students in the academic year 2016/2017 (*Group B*) had to complete the same tasks using the "iVideo" (iVideo, 2018) software, an HV system also integrating video annotation functions. Specifically, the second group had to make the video-interview in the form of an HV and to draft the reflective report by inserting video annotations through the dedicated iVideo feature. The same *Group B* also participated in a 4-h long training session on the HV and were assisted by a tutor in order to solve any technical problems that could arise with respect to the creation of the HV. On the contrary, as previously mentioned, the students of *Group A* didn't receive any dedicated training or support as they did not use the HV software. All the students involved (Group A and Group B) could choose the working method for video production, that is to say, teamwork or individual work. The students who chose to produce the video together with other peers also had to write a part of the reflective report individually. The students of *Group A* and *Group B* who chose to make the video-interview and draft the reflective report (the option explained above) to carry out the third part of the exam were involved in the research. All the interviewees signed a standard consent form which explicitly allows for the use of the gathered video-material for research purposes. The department' ethics committee approved the standard consent form.

Data collection

In academic year 2015/2016 the 74% of students choose to make the video-interview, while in academic year 2016/2017 the 69% chose this option. All the videos produced and the reflective reports drafted by the students of Group A and

Table 1 Overview of the collected data

Academic Year	Technology used	Sub-group	Students' Working Method	Amount of collected videos	Amount of collected reflective reports	Amount of selected videos
2015/2016	Gr. A (unspecified)	At	Team work	38	84	14
2015/2016	Gr. A (unspecified)	Ai	Individual work	29	29	14
2016/2017	Gr. B (iVideo)	Bt	Team work	30	69	14
2016/2017	Gr. B (iVideo)	Bi	Individual work	15	15	14

Group B were collected and catalogued. The materials of the students who did not comply with both the requests or who did not receive an evaluation on the same were not taken into consideration for the purposes of the study. All of the formats of the text files were checked and, if necessary, converted to ensure compatibility with Nvivo 11 software (Nvivo Pro.11, 2015). The materials gathered with respect to each group have been divided into as many sub-groups, depending on the working methods employed by the students (teamwork or individual work). The following Table 1 shows the numbers pertaining to the materials collected for each group. One hundred ninety-seven reflective reports and 112 videos were collected altogether.

In addition to the materials submitted by the students, the grades attributed by the teacher to the students were also collected. Only the marks related to the third part of the exam described above were taken into account for the analysis because the other two parts concerned different contents and learning materials.

In order to define the corpus of data relevant for the analysis, the reflective reports of each sub-group were ordered from the lowest mark to the highest mark. After that, in every sub-group, 7 reflective reports with the highest grade and the 7 reflective reports with the lowest grade were selected for the analysis, for a total of 56 texts. The length of both the reflective texts (measured in words) and the corresponding videos (measured in seconds) was collected and added to the data set.

Step 1 – the codebook' drafting

As mentioned above, in order to outlying a codebook based on the students' reflective reports, a sample of reflective texts was randomly taken out of the entire corpus of data. In accordance with the Corbin and Strauss' GT approach for data analysis (Corbin & Strauss, 2008), the selected reports were analyzed by following the open coding and axial coding procedures, which provide for the establishment of a category system based on data. The analysis was conducted pursuant to the following research questions: What are the characteristics of the reflective reports? What are the main topics discussed by the students in their reflective texts? The coding was carried out separately by two coders who generated two different sets of categories and coding. The two coders and a third member of the research team compared the sets of categories in order to obtain a unique and shared coding system through a dialogic process. The obtained coding system –reported in Table 2 – is composed by a hierarchy of categories and sub-categories inductively based on data with 21 coding possibilities.

On the basis of the hierarchy reported in Table 2, a guideline document for coders - a codebook - was drafted. The codebook contains the following elements: the coding procedure; the minimum size of the coding units; the category system; the description and explanation of categories and subcategories; examples of pieces of text coded using the procedure.

The codebook was tested and tuned up by the research team employing it on a sample of reflective reports which were randomly selected from the sources excluded from the corpus of analysis. Before proceeding with the coding of the sample, the two coders were involved in a intense training on the use of codebook and

Table 2 The coding system and its categories

Hierarchy of categories			
1st Hierarchy Level		2nd Hierarchy Level	Category Label
The Student	reports / Describes / Narrates	Work-related events	A
		education and / or training-related events	B
		Assignment-related events	C
	reflects on the job or the work (regarding)	the interviewee	D
		their work	E
		Work in general	F
	reflects on education and / or training (regarding)	regarding the interviewee	G
		their education and training	H
		education and training in general	I
	reflects on submitted assignments	reflective-report drafting	L
		videomaking (technical aspects)	M
		interview preparation and conducting	N
		post-production (editing etc.)	O
		cooperating with peers	P
		the assignment in general	Q
	reports on what the interviewee disclosed - through a description - about experiences regarding	work and personal life	R
		interpersonal relationships	S
	reports on what the interviewee disclosed - through a reflection - about experiences regarding	work and personal life	T
		interpersonal relationships	U
Cross-cutting categories[a]		the student refers to specific moments in the video or interview	V
		the student refers to the teaching module's contents	Z

[a]Unlike other coding possibilities, cross-sectional categories can be used by programmers on already encoded portions of text

Nvivo 11 software (Nvivo Pro.11, 2015): several tests were made to ensure that they understood the meaning of the categories and how to attribute them to the parts of the text.

Step 2 –the sample' coding

The 56 reflective reports selected for the analysis were distributed to the two coders and were analyzed separately using the Nvivo 11 software (Nvivo Pro.11, 2015) and following the codebook guidelines. Three texts were analyzed by both the coders to check the intercoder agreement. Given the high number of coding options (21), the coefficient of interclass correlation through test F was calculated on the three texts' encodings using SPSS software (IBM SPSS Statistics, 2011). The intercoder agreement was confirmed as the coefficients resulted > 0.6 in all three cases and their mean was 0,801 (SD = 0.1583). After that, thanks to the *matrix coding* feature of Nvivo 11 software (Nvivo Pro.11, 2015), the coding frequencies of all categories, in terms of word number, have been obtained. The

word number was chosen as the unit of measurement because it could well express the space dedicated by the students in the reflective reports to the topics identified through the categories. All the emerged data were organized into a data set which was then analyzed using SPSS software (IBM SPSS Statistics, 2011). The use of quantitative analysis methods reported below does not have the ambition to generalize the results of this explorative study, but to provide a precise and detailed answer to the research question and to highlight also unexpected outcomes, which are not inherent to the research question, but still interesting for the research topic.

Results

Reflective reports and corresponding video characteristics

Descriptive statistics (means (M) and standard deviations (SD)) about the characteristics of reflective reports and corresponding videos split into groups A and B are reported in Table 3.

Looking at the differences between the group means, the Group B condition (using HV and video annotation) seems to affect the video duration and reflective report length. The Pearson coefficients confirmed the presence of a correlation both between video length and study group conditions ($r(56) = -.377$, $p < .005$) and between the latter and report length ($r(56)$-.510, $p < .001$). On the contrary, the correlation between video and report length is not significant (r(56).112, $p = .372$). The independent-sample T-test and the effect-size coefficient confirmed the trend:

- there was a significant difference in the video length for Group A and Group B conditions; $t(54) = 2.994$, $p < 0.01$,$d = 0.800$
- there was a significant difference in the report length for group A and Group B conditions; $t(54) = 4.362$, $p < 0.001$,$d = 1.166$

Table 3 Report and video characteristics split into Group (A and B) and subgroups (At, Bt, Ai, Bi)

	Sub-group/group	N	M	SD
Video Time (in seconds)	At	14	779,64	295,189
	Ai	14	847,50	326,643
	A	28	813,57	307,442
	Bt	14	625,14	155,593
	Bi	14	595,57	216,685
	B	28	610,36	185,714
Reports' length (Words number)	At	14	1315,71	311,955
	Ai	14	1265,93	425,771
	A	28	1290,82	367,127
	Bt	14	611,36	384,896
	Bi	14	919,29	604,213
	B	28	765,32	521,237

Significant correlations between working methods employed by the students (teamwork or individual work) and the video-time or the report length were not found.

Frequencies of the coding categories

Due to the significant difference between the report length of group A and B, the frequencies of the coding words in each group needed to be uniform in order to allow the comparison to take place. To this end, the percentage of coded words in each category has been calculated based on the number of coded words for each group individually. Given the peculiarities of the cross-cutting categories V and Z, the percentages referring to the same have been calculated separately. Table 4 reports the descriptive statistics about the categories' coding frequencies split into group A and group B: the sum, the mean, and the standard deviation of coded words (∑, M, SD), and the respective standardized values for the purpose of a comparison (∑%, M%, SD%). Looking at the combination of M% of group A and B, that is highlighted in Fig. 1, several differences between group A and B can be observed.

Statistics were employed to underline the main differences in this instance as well. In particular, a correlation matrix has been employed to highlight the principal correlations between variables, and a T-test was used to confirm the differences between the Groups. According to the results of the correlation matrix (see Appendix), the categories "C" ($r(56) = -.406$, $p < .005$) and "I" ($r(56) = -.304$, $p < .005$) have a significant correlation with the use of video annotation. Even the correlation with category "D" ($r(56) = -.220$, $p = 0.103$) was taken into account because its p-value is closer to 0.05 than the other categories. The independent sample T-test was applied to the categories highlighted above to verify the hypothesis: Group A ≠ Group B. As shown in Table 5, this hypothesis is thus confirmed for categories C and I. This means that there is a significant variation in the number of coded words between the groups both for category C ($p = .002$) and for category I ($p = .023$). The hypothesis is not formally confirmed for category D ($p = .103$), but, given that the p-value is marginally significant with $\alpha = .10$, that the value of Cohen's d suggests a slight effect ($d = -.443$), the difference between Group A and Group B for this category were taken into account too.

Descriptive statistics also show that the means of cross-cutting categories (V and Z) are greater for Group B than for group A, but the correlation coefficient didn't result significant for any of the two.

Discussion

By cross-referencing all the results concerning the reflective reports and the corresponding video characteristics, we could deduce that the students who completed the task employing HV and video annotation (Group B) produced videos and reports that were shorter than the students who completed the tasks employing unspecified video tools (Group A). This suggests that the students in Group B followed the guidelines proposed during the training on HV, which suggested an average duration of 3 to 5 min for each HV (Cattaneo & Sauli, 2017), but also that the HV editing features (e.g. the possibility to add links, information and attachments in particular times of the video) led the users to produce videos which are not only more concise but also richer of information than a standard video.

Table 4 Descriptive statistics per each coding category

Category label	Group A						Group B					
	∑	M	SD	∑%	M%	SD%	∑	M	SD	∑%	M%	SD%
A	62	2.2143	11.7169	.1830	0.0065	.0346	663	23.6786	86.0715	3.1540	.1126	.4095
B	33	1.1786	6.2364	.0980	0.0035	.0185	368	13.1429	56.0877	1.7510	.0625	.2668
C	11,384	406.5714	183.7652	33.6510	1.2018	.5432	4011	143.2500	135.9372	19.0820	.6815	.6468
D	6449	230.3214	155.0544	19.0600	.6807	.4584	5799	207.1071	180.2684	27.5900	.9854	.8577
E	741	26.4643	50.3650	2.1910	.0783	.1490	806	28.7857	86.8811	3.8350	.1370	.4134
F	6302	225.0714	194.1246	18.6270	.6653	.5738	3165	113.0357	148.1392	15.0590	.5378	.7048
G	478	17.0714	33.7199	1.4130	.0505	.0997	277	9.8929	16.9735	1.3180	.0471	.0808
H	261	9.3214	44.1547	.7720	.0276	.1306	372	13.2857	45.5110	1.7690	.0632	.2164
I	316	11.2857	35.2618	.9330	.0333	.1042	833	29.7500	46.4532	3.9650	.1416	.2211
L	0	.0000	0.0000	.0000	.0000	.0000	154	5.5000	21.6820	.7320	.0261	.1031
M	42	1.5000	4.9103	.1250	.0045	.0146	81	2.8929	10.7267	.3860	.0138	.0511
N	836	29.8571	47.8336	2.4720	.0883	.1414	757	27.0357	60.9155	3.6020	.1286	.2899
O	208	7.4286	21.1843	.6150	.0220	.0626	77	2.7500	10.6549	.3670	.0131	.0508
P	178	6.3571	17.9283	.5270	.0188	.0531	177	6.3214	20.9674	.8420	.0301	.0997
Q	3282	117.2143	100.6377	9.7030	.3465	.2974	1566	55.9286	60.8446	7.4490	.2660	.2895
R	1848	66.0000	73.9124	5.4630	.1951	.2185	932	33.2857	56.4983	4.4350	.1584	.2689
S	358	12.7857	29.3350	1.0580	.0378	.0867	356	12.7143	31.1280	1.6920	.0604	.1480
T	1009	36.0357	53.7618	2.9820	.1065	.1589	625	22.3214	37.6770	2.9730	.1062	.1792
U	43	1.5357	8.1262	.1270	.0045	.0240	0	.0000	0.0000	.0000	.0000	.0000
∑	33,830			100			21,019			100		
V	1287	45.9643	53.2642	27.9540	0.9984	1.1569	1516	54.1429	64.6694	38.1740	1.3634	1.6285
Z	3317	118.4643	104.6360	72.0490	2.5732	2.2728	2455	87.6786	104.2590	61.8230	2.2080	2.6254
∑	4604			100			40,967			100		

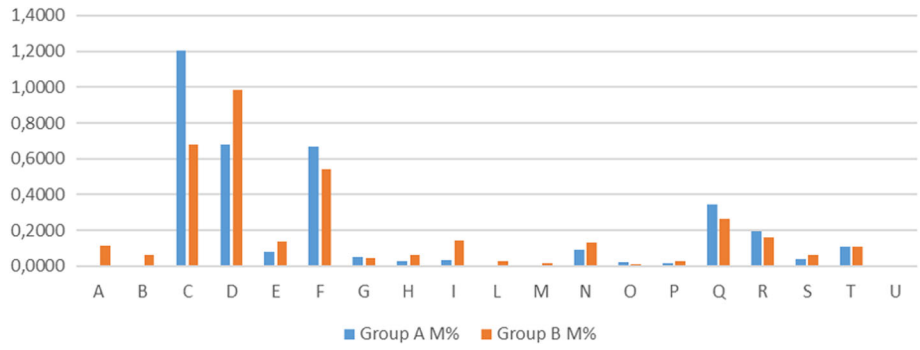

Fig. 1 Uniformed means comparison

With regard to the frequencies of the coding categories, according to the emerged evidence, the use of HV technology led students to edit videos and to draft reflective reports differently. It seems that the students who used HV focused on describing assignment-related events significantly less than the students who didn't use this specific educational technology (category C). On the contrary, the students who used HV focused their reflective activity on the topic of education and training significantly more than the other group of students (category I). Furthermore, even if the T-test results are only marginally significant with $\alpha = .10$, the use of HV seems to facilitate students also in reflecting on the interviewees' work activities (category D). On this basis, it can be deduced that on one hand the group of students who used video annotation allowed more room and paid more attention to reflection activities than the other group; on the other and, the group that didn't use the video annotation kept more attention to descriptions. This outcome could be due to the fact that using video annotation forces the users to write the reflective reports in correspondence with video specific segments while they are watching the video. In this way, the students may pay more attention to the reflective thinking as they did not need to remember nor to textually reproduce the content of the video. In other words, the "description" is not so needed any more as it is immediately available and directly connected with the written reflection. This outcome would also confirm that the cognitive load theory (e.g. Sweller, 1988, 2011) has implication in HV and instructional design, as highlighted by several authors (Cattaneo, van der Meij, Aprea, Sauli, & Zahn, 2018; Bonaiuti, 2012; Bonaiuti, Calvani, Menichetti, & Vivanet, 2017; Sauli et al., 2018). All considered, these results suggest that the HV had the potential to really become a boundary object, able to support students in articulating and connecting what they learnt at the university in theory and what they could see and document through their interviewees in the world of professional practice. By means of its facilities, and above all by the annotation tool, the HV provided a way to support reflection, i.e. one

Table 5 Independent samples T-Test for equality of means

	T	df	*p*	Cohen's d
C	3.260	54	.002	.871
I	−2.345	54	.023	−.627
D	−1.658	54	.103	−.443

of the main learning mechanisms connected to boundary crossing (Akkerman & Bakker, 2011). Although in the experience reported here the use of the HV was framed within a specific assessment task, this observation has interesting implications on curricula design: HV and video annotation could in fact become an interesting means to support boundary crossing and reflective activities across different (formal, informal, non-formal) learning contexts.

Limitations

Given its explorative nature, this study presents some limitations. Firstly, not all the collected data were deeply analyzed, forcing the researcher to restrict the corpus of the analysis, which could be extended at a later stage; secondly, the students' grades concerning the whole exam were not taken into account: controlling for this variable could provide additional evidence on the process the students went through. Furthermore, all the participants carried out the assignment on a voluntary basis, as the realization of the video was not mandatory. This choice automatically excluded all the students who were not motivated for - or frightened by - the use of technology. Finally, another limitation of the present study is due to the fact that only the video annotation feature of iVideo was considered. So, the data analysis did not take into account possible reflexive processes which could be occurred during the production of an HV through others iVideo' features (e.g., active points, attachments, subtitles, etc.)

Conclusions

As shown in the section before, the results of the statistical analysis highlighted two sets of information. The first set answers the research question about the use of HV and video annotation, while the second provides new elements concerning the use of reflective activities and video technologies regardless of their specific characteristics - to better articulate the gap between education and work context. Furthermore, the category system emerged from the first macro-step is composed of a hierarchy of categories and sub-categories inductively based on data with 21 coding possibilities. This coding system could be considered one of the study outcomes because it could be employed in different contexts (in research or teaching filed) to analyze the content of work practices reflexive-reports. In summary, the use of HV and video annotation seems to allow students to better center their focus on reflection rather than on description; to this extent, the efficacy of the use of video as educational technology, already outlined by the Hattie (2009) meta-analysis results, has been confirmed. Furthermore, in line with the Efrahrraum model (Schwendimann et al., 2015), the effectiveness of technology and reflexive activity combination in VET-related learning contexts has been highlighted: the use of video associated with a reflective activity allows students to improve pedagogical skills, approaching at the same time specific vocational skills, going beyond the boundaries of the classroom learning context. So, ultimately, the HV and video annotation could be considered an appropriate tool for supporting instructional activities in higher education courses concerning the VET field.

Appendix

Table 6 Bivariate correlation matrix between groups, sub-groups and categories

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1. Technology used (Group A / Group B)	1	0,000	0,000	,183	,157	-,406**	,220	,096	-,100	-,019	,101	,304*	,180	,125	,090	-,079	,072	-,138	,095	-,001	-,135	,130	-,076
2. Work capacity (Individual / team)	0,000	1	0,000	-,092	-,157	,069	-,164	-,058	-,164	-,141	-,101	,038	,068	-,035	,187	-,181	,099	-,136	-,197	,176	,135	-,196	,043
3. Student marks (Lowest / Highest)	0,000	0,000	1	,078	,148	,270*	,459**	,194	,345**	-,170	,037	,091	,180	,222	,159	,269*	,011	,212	,003	,092	,135	,383**	,360**
4. A%	,183	-,092	,078	1	-,030	-,107	,151	,827**	,057	,131	,276*	,413**	-,037	-,050	-,099	-,064	-,064	-,178	,290*	,012	,057	-,008	,213
5. B%	,157	-,157	,148	-,030	1	,018	,064	-,038	-,044	-,059	,218	,198	-,032	-,043	-,085	-,055	-,055	-,116	,025	-,081	-,024	,256	-,036
6. C	-,406**	,069	,270*	-,107	,018	1	,108	-,060	,049	,114	-,020	-,114	-,143	,236	,214	,157	-,047	,298*	-,008	,104	,219	,238	,179
7. D	,220	-,164	,459**	,151	,064	,108	1	,157	,386**	-,063	-,022	,078	,053	-,147	,206	-,100	,089	,081	,067	,122	,042	,548**	,456**
8. E	,096	-,058	,194	,827**	-,038	-,060	,157	1	,174	,043	,190	,294*	,175	-,080	-,143	-,110	,010	-,179	,230	-,042	,143	,044	,263
9. F	-,100	-,164	,345**	,057	-,044	,049	,386**	,174	1	,139	-,091	-,106	,311*	-,089	-,071	-,127	-,189	,046	,055	,006	-,027	,454**	,604**
10. G	-,019	-,141	-,170	,131	-,059	,114	-,063	,043	,139	1	,226	,032	-,098	,034	,001	-,009	-,021	-,091	,464**	,105	-,074	-,026	,064
11. H	,101	-,101	,037	,276*	,218	-,020	-,022	,190	-,091	,226	1	,232	-,046	-,063	-,124	-,080	-,080	,016	,642**	,081	-,035	,092	,145
12. I	,304*	,038	,091	,413**	,198	-,114	,078	,294*	-,106	,032	,232	1	-,088	,161	,142	-,076	-,019	,114	,031	,120	-,066	,074	,142
13. L	,180	,068	,180	-,037	-,032	-,143	,053	,175	,311*	-,098	-,046	-,088	1	-,044	-,025	-,056	-,056	-,027	-,042	,052	-,024	,222	-,037
14. M	,125	-,035	,222	-,050	-,043	,236	-,147	-,080	-,089	,034	-,063	,161	-,044	1	,207	,284*	-,076	,121	-,091	-,134	-,033	,030	-,132
15. N	,090	,187	,159	-,099	-,085	,214	,206	-,143	-,071	,001	-,124	,142	-,025	,207	1	-,010	,025	,244	-,090	,227	-,065	,164	,074
16. O	-,079	-,181	,269*	-,064	-,055	,157	-,100	-,110	-,127	-,009	-,080	-,076	-,056	,284*	-,010	1	,025	,245	,098	-,035	-,042	,049	-,178
17. P	,072	,099	,011	-,064	-,055	-,047	,089	,010	-,189	-,021	-,080	-,019	-,056	-,076	,025	,025	1	,126	-,039	-,140	-,042	-,055	-,108
18 Q	-,138	-,136	,212	-,178	-,116	,298*	,081	-,179	,046	-,091	,016	,114	-,027	,121	,244	,245	,126	1	-,034	-,127	,084	,294*	,015
19. S	,095	-,197	,003	,290*	,025	-,008	,067	,230	,055	,464**	,642**	,031	-,042	-,091	-,090	,098	-,039	-,034	1	,083	,171	,194	,086
20. T	-,001	,176	,092	,012	-,081	,104	,122	-,042	,006	,105	,081	,120	,052	-,134	,227	-,035	-,140	-,127	,083	1	-,086	-,005	,078
21. U	-,135	,135	,135	,057	-,024	,219	,042	,143	-,027	-,074	-,035	-,066	-,024	-,033	-,065	-,042	-,042	,084	,171	-,086	1	,156	,123
22. V	,130	-,196	,383**	-,008	,256	,238	,548**	,044	,454**	-,026	,092	,074	,222	,030	,164	,049	-,055	,294*	,194	-,005	,156	1	,264*
23. Z	-,076	,043	,360**	,213	-,036	,179	,456**	,263	,604**	,064	,145	,142	-,037	-,132	,074	-,178	-,108	,015	,086	,078	,123	,264*	1

**. Correlation is significant at the 0.01 level
*. Correlation is significant at the 0.05 level

Abbreviations
GT: Grounded Theory; HV: Hypervideo, interactive video; TQTA: Thematic Qualitative Text Analysis; VET: Vocational Education and Training

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MP conducted the study and wrote the manuscript; AC made substantial contributions to research design, manuscript drafting, and revision; GT was involved in study conception, research design, and data collection. All authors read and approved the final manuscript.

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The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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