Referentiality in Secondary Teachers' Video Observation of Others' Teaching

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This article presents a study of individual video-based educational sessions with secondary trainee teachers ($N = 30$) observing others' teaching. Within a Peircian semiotic framework, the study was designed to deepen the researchers' understanding of video-enhanced experience in educational settings beyond the usual research areas of noticing, interpreting and reflecting. Facilitated think-aloud protocols were used, the trainees' verbalizations were transcribed and the data were coded using semiotic schemes. The analysis revealed eight referentiality items jointly underlying the teachers' activities of description, interpretation, and evaluation while video observing. The results suggest the need to acknowledge the dimension of referentiality in video observation as a legitimate object of research, instructional design, and facilitation in the field of teacher video-enhanced education, especially during the induction period.

Theoretical Background

Viewing teaching videos engages teachers in perceptual, cognitive, affective, and emotional processes that are interrelated and difficult to separate. For the past 15 years, the literature has generally tended to summarize video observation as the expression of cognitive processes pertaining to teacher noticing (e.g., Sherin & van Es, 2005), interpretation and reflection (e.g., Rosaen, Luneberg, Cooper, Fritzen, & Terpstra, 2008), and the interplay of these abilities (e.g., Sherin & van Es, 2009).

The instructional hypothesis underlying these approaches is that teacher effectiveness greatly depends on "the ability to interpret significant interactions in a classroom" (Sherin, Russ, Sherin, & Colestock, 2007, p. 28). Educators, therefore, assume that objectively meaningful elements exist in teaching situations that experts know better than beginners, which explains in part their greater effectiveness or their *professional vision.*

Borrowed from the field of linguistic anthropology (Goodwin, 1994) and in line with Sherin's (2007) thinking, professional vision in the educational field is usually conceptualized as the interplay between *selective attention* (how teachers determine where to focus their attention) and *knowledge-based reasoning* (how teachers reason about what they notice). From this perspective, a major goal of teacher education is to develop professional vison. Videos are used to teach teachers how to notice key events in the classroom and interpret them productively in the light of relevant prior knowledge, so that they can act effectively. One of the current preoccupations in education research is the design of video-supported learning environments that promote productive reasoning by tuning teachers' attention to classroom interactions in particular ways (Sherin & Russ, 2014).

The focus on noticing as the basis for reflection is heuristic in the instructional sciences but has come under question in the literature. First, this focus tends to reduce video to an indirect learning tool, whereby viewers enhance their own teaching through reflection (Davis, 2006). Yet, many studies have shown that video-enhanced experiences can offer more direct learning opportunities to teachers by reconfiguring prior experiences (e.g., Kleinknecht & Schneider, 2013; Leblanc & Ria, 2014; Zhang, Lundeberg, Koehler, & Eberhardt, 2011). The prevalence of video-enhanced *indirect learning* in the literature can be explained to some extent by the fact that most of the studies involve preservice teachers in their initial classroom experiences (Blomberg, Renkl, Sherin, Borko, & Seidel, 2013). Yet these teachers have little or no teaching experience and therefore have to conceive teaching more than reenact and reconfigure it.

Second, the research rarely looks at other components (perceptual, affective, and emotional processes) of video-enhanced teacher experience as modes of learning. Either the studies overlook these learning modes or they consider them as resources or obstacles to the instructional approach (e.g., Lefstein & Snell, 2011). Third, the relationship between noticing and reflection is often seen as sequential and has been challenged by those studies with a more holistic research perspective on video observation (Brouwer, 2014; Brouwer & Robijns, 2014).

These criticisms have inspired a trend that is encouraging researchers to interpret video-enhanced experiences using new frameworks that put greater emphasis on meaning. The meaning-based perspective spawned several studies of video observation that described the relevance of cognitive categories (Chan & Harris, 2005), sense-making strategies (e.g., Colestock & Sherin, 2009), interpretive frames (e.g., Sherin & Russ, 2014), and classes of signs (e.g., Lussi Borer & Muller, 2014a).

These studies offered new insights into the nature of teachers' activity as they view a classroom video, and these insights have been critical in the design of more effective video-based devices and programs for teacher education and professional development (Gaudin & Chaliès, 2015). Although these studies have had different goals, they show agreement in the documentation of different types of cognitive activity (e.g., description, comparison, and evaluation) in reference to different types of activity (e.g., the activity of the observed teacher and the observed students, the observing teacher's own activity, and colleagues' activity). We have termed this recurring relating of one activity to another *referentiality* (Lussi Borer & Muller, 2014c, 2016).

Most of the existing research has examined video observation in a dual way, that is, a relationship between an observing teacher and an observed teaching. Yet, teacher vocational learning generally consists in an interpenetration of multiple experiences (König et al., 2014). Therefore, we assume that (a) video-based education falls under a multireferenced mode of experience development, (b) referentiality is a key concept to account for this mode, and (c) such a nondual perspective deserves to be studied using suitable theoretical and methodological frameworks.

Meaning-based studies have shown that the semiotic perspective is fruitful for describing not only the mental processes at work, but more broadly the experiences that are lived and enhanced by video observation. Yet, this undertaking is complicated by the many meanings, inferences, and references that teachers produce in observation situations, all depending on the nature of several factors: their preoccupations of the moment (Gaudin, Flandin, Ria, & Chaliès, 2014), their personal learning goals (Brouwer, 2014), the characteristics of their workplace (Lefstein & Snell, 2011), and so on. Therefore, the literature would be enriched by a deeper "sense of the kinds of structures that drive and give rise to this contextuality and interdependence" (Sherin & Russ, 2014, p. 4).

We assume that referentiality is one of these structures and needs to be investigated. We designed our study wondering how teachers notice and make sense of the observation of others' teaching when they are prompted to do so. To address this question, we introduced five classes of signs and eight referentiality items that we identified in our data, and we explored their relationships in the situation of video observation. The originality of this study is the focus not only on the teachers' thinking about the observed teaching, but also on their references to other activities that they recall while observing.

A Semiotic Approach to Teachers' Video Observation

Our study is conducted within the framework of semiotic theory (Peirce, 1935). The activity of observation is considered an ongoing semiosis that can be described by successive signs that are embedded in the unfolding viewing (see Appendix A).

Peirce's Semiotic Theory is used to identify signs of different levels evoked by video observation and to distinguish two main modes of relationship to the viewed activity, depending on whether the trainee teachers (TTs) produce signs that refer to the viewed activity itself or to the relationship of the viewed activity with another activity (Lussi Borer & Muller, 2014c; 2016). We chose to focus on the relationship of the viewed activity to another activity, as the results of the following studies still need to be substantiated:

- TTs relate different activities to the viewed activity, going beyond their own activity only (Lussi Borer & Muller, 2014a). It is interesting to identify which kinds of activities they relate and how they refer to these activities of others.
- TTs' preoccupations are mainly self-centered (Huberman, 1989), a self-centration that occurs also in video observation as TTs have a propensity to refer the viewed activity to their own activity (Leblanc & Ria, 2014). We are interested in the kind of relationship they are drawing.
- TTs make sense while viewing videos of the typical activities of peers, both dependently and independently of the characteristics of the instructional design (Gaudin et al., 2014). For this reason, open think-aloud protocols are appropriate to access these experiences rather than predefined and closed query protocols.
- In secondary education, teachers have little opportunity to observe the activity of experienced colleagues (sometimes they see their mentor teacher), and even less so their novice peers. Thus, viewing video excerpts of their peers during a

vocational program promotes the recognition of the situations shown and analyzed at the university, identification with these peers, and the experience of their activity by proxy (Brouwer, 2014; Lemke, 2007; Miller & Zhou, 2007).

- When teachers are encouraged to speak about viewing the activities of unknown peers (notably with open protocols), the remarks about the activity are a mix of facts, events, and values that are not always easy for the researcher to distinguish (Brouwer & Robijns, 2014; Erickson, 2011), a difficulty common in ordinary language (Putnam, 2002).
- Video observation encourages teachers to express the values and norms they use to compare and evaluate the viewed activity in relation to another activity that they refer to (Flandin, 2015; Lussi Borer & Muller, 2014b; Miller, 2011).

Consistent with these studies, we examined the activities that TTs relate to the activities they are viewing and how they do so to give meaning to the activity they are viewing. The relationship between these two activities can be described using one of the five classes of signs (description, paralleling, comparison, contrasting, or evaluation) constructed from the logical a priori analysis based on Peirce's Semiotic Theory (see Appendix B; Lussi Borer & Muller, 2014c). Then, we analyzed the experience of video education they are living.

Method

Participants and Context

We conducted a study of individual video-enhanced educational sessions with 30 TTs following the first year of a 2-year vocational university program for secondary teachers. Most of the university program is dedicated to disciplinary content-knowledge (58 academic credits, or ECTS, out of 94) [a]. The rest of the university program is dedicated to cross-disciplinary dimensions of the teaching profession: historical, sociological and psychological issues; assessment; classroom management; and information and communication technology (36 ECTS out of 94). The study took place in a cross-disciplinary module (6 ECTS) designed to introduce issues concerning the teaching profession, with a focus on classroom management. The module was based on video analysis, and the objective was to scaffold analysis and reflection on teaching and support the first teaching experiences in a cross-disciplinary manner. More specifically, the goal was to build such professional skills as developing management rules, techniques and strategies; designing educational settings; establishing rituals; giving instructions; and improving facilitation.

Throughout the module, the TTs were regularly visited in their classrooms by their university supervisors and mentor teachers. During the first part of the module, the TTs viewed several other novice and expert teacher videos, reflecting on and discussing the teaching issues. The videos were focused on the beginning of lessons in different academic disciplines and how the teachers got the students working. Based on a developmental instructional approach, the videos offered a range of examples of typical problems in classroom management and different coping strategies and teaching modalities.

Indeed, during the induction year, training TTs to deal with classroom management issues is a priority (OECD, 2014, pp. 496-497). Moreover, education may have a particularly significant impact on the improvement of classroom management (e.g., Dicke, Elling, Schmeck, & Leutner, 2015; Oliver, Wehby, & Nelson, 2015). Therefore, TTs' preparation for classroom management is a suitable configuration for investigating what and how they observe and learn in educational settings, based on video in this case.

Video Characteristics and Data Collection

The study occurred at the end of the first semester of the cross-disciplinary module (academic year 2013-2014). The 30 TTs following the module were from different academic disciplines (see Table 1). During individual sessions, we asked the participants to view and comment on a video excerpt (9 min. 42 sec.) showing an experienced teacher beginning a French lesson with 15-year-old students. In the excerpt, the experienced teacher is dealing with several classroom management issues. She must deal with students who are late, do not sit down in their assigned seats, do not remove their coats and continue talking. She used nonverbal communication to obtain silence from her students before getting them to start their work, and she then enters into a subtle power struggle with a disruptive student who tried to provoke her and derail the lesson. We chose this video excerpt because we assumed that these classroom management issues are typical enough to prompt the TTs to relate them to other videos they have seen in the module or with their own classroom practices or those of colleagues or mentor teachers.

We facilitated the TTs' comments about the meaning they constructed while viewing the video using a think-aloud protocol. The TTs could stop the video whenever they wanted or comment while observing. If they did neither, we would then ask after the video excerpt: "What did you notice?" We would keep asking for more detail until the TT finally said, "Nothing else." The trainees' verbalizations were videotaped and transcribed verbatim. They lasted between 15 and 35 minutes. The data are presented and quantified in Table 1.

Table 1
Trainees, Academic Disciplines, Verbalization Time, and Signs

No. of Trainees	Academic Disciplines	Verbalization Time	No. of Signs
1	Computer Science	00:22:08	13
	English	00:24:02	9
	English	00:20:04	5
3	English	00:18:33	11
	French	00:19:58	17
	French	00:27:40	12
	French	00:20:07	7
	French	00:16:42	7
5	French	00:19:55	6
	Geography	00:18:59	11
2	Geography	00:38:11	23
1	History	00:30:25	6
	Mathematics	00:24:49	8
	Mathematics	00:18:50	10
8	Mathematics	00:16:25	23
	Mathematics	00:18:43	12
	Mathematics	00:18:19	14
	Mathematics	00:15:05	6
	Mathematics	00:18:32	10
	Mathematics	00:19:48	2
1	Nutritional Education	00:31:10	7
	Physics	00:20:06	5
	Physics	00:19:16	2
3	Physics	00:38:00	18
	Sports	00:17:16	5
	Sports	00:20:42	19
	Sports	00:23:41	11
4	Sports	00:24:18	4
	Visual Arts	00:19:10	5
2	Visual Arts	00:13:30	5
Total			
30		10:54:24	293

Data Processing

We analyzed the verbalization data in three steps:

Step 1. The data were divided into sign units. Sign units were segments of the TT remarks in which a relationship was drawn between the viewed teacher activity and another activity. Two researchers segmented each transcript. Interrater reliability was over 85%, and disagreements were resolved through consensus. The individual verbalizations consisted of between two and 23 sign units each (average: 9.8 signs/TT), with a total of 293 sign units across the 30 verbalizations, which lasted for 10 hours 54 minutes.

Step 2. The type of activity that the TTs put into relationship with the activity viewed in each sign unit was described by two researchers. Interrater reliability was over 95%, and disagreements were resolved through consensus. Eight referentiality items were found (see Table 4), and the TTs used between one and seven referentiality items each (average: 3.8 items/TT).

Step 3. We logically defined the possible relationship between the viewed activity and another activity using the five classes of signs based on Peirce's Semiotic Theory (see Table 2 and Appendix B for the construction of the classes of signs).

Based on the five classes of signs, two researchers coded the relationship between the viewed activity and another activity expressed by the participants in signs units. Interrater reliability was over 90%, and disagreements were resolved through consensus. Out of the five classes of signs, TTs used between one and five classes (average: 3 classes/TT).

Results

We obtained two orders of results. First, the five classes of signs were distributed almost exclusively and equally into three classes (contrasting, comparison, and evaluation), with few remarks falling into the two other classes (description and paralleling). Second, we found eight items of referentiality (distributed in a variable way).

Classes of Signs Used by the TTs to Relate the Viewed Activity to Another Activity

The distribution of signs based on the TTs' video observation is presented in Table 3 and Figure 1.

The two categories description and paralleling were underrepresented, being used by only seven TTs, while the two categories contrasting and evaluation — which imply value judgment — accounted for almost two thirds of the signs that were produced and were used by almost all TTs. Through these judgments, the TTs revealed the norms they used to contrast and evaluate the viewed activity in relation to another activity. Comparison, a category that does not imply value judgments, accounted for almost one third of the signs produced, similar in prevalence to the categories confrontation and evaluation.

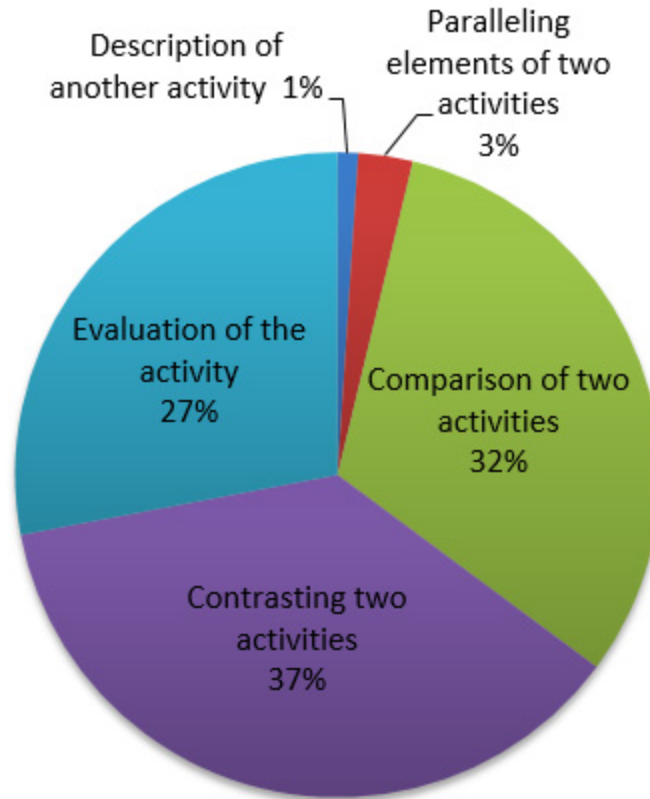## Referentiality Items Used by TTs to Relate the Viewed Activity to Another

Table 4 and Figure 2 show the number of occurrences and the distribution of the eight items of referentiality.

Table 2
Definitions and Examples of the Five Classes of Signs

Class of Signs	Definition	Examples
1. Description of another activity	The viewed activity prompts the description of another activity, with nothing about their relationship being said.	A TT comments on a video showing a silent class: "But you know, you get used to horsing around like this…. I was a substitute in May and June…. I had a class of 14-year-olds and two classes of 11-year-olds … and there was still a lot of horsing around…"
2. Paralleling elements of two activities	The events of the viewed activity prompt the description of similar events in another activity.	A TT comments on a video showing a teacher waiting passively for the students calm down, with arms folded across his chest: "That's happened to me … and sometimes I do the same thing [crosses the arms on his chest]…"
3. Comparison of two activities	The viewed activity is compared (in terms of similarity or difference) to another activity.	A TT comments on a video showing a teacher who manages her class by the look in her eye and a calm manner: "Well, that's what I tend to do…. I'm actually pretty calm…"
4. Contrasting two activities	The viewed activity and another activity are contrasted with one used to judge of the other.	A TT comments on a video showing a teacher who comes out of her class to put students in line: "Here, a lot of students have already entered … and she goes out to manage the horsing around … no … you don't leave the classroom!"
5. Evaluation of the activity	The viewed activity is evaluated against an exemplary activity. An exemplary activity is an *ideal* activity defined as *do's and don'ts* according to a system of norms and values.	A TT comments on a video showing a teacher who has her students line up in front of the classroom: "Making 13- and 14-year-old students line up … before entering the classroom … for me there, typically … it begins to look like the military… and it is absolutely not adapted to their everyday social reality…"

Table 3
Classes of Signs Used by the Trainee Teachers to Relate the Viewed Activity to Another Activity

| Class of Signs	No. of Teachers Using the Class of Signs (TTs = 30)	No. of Sign Units in the Class of Signs Used (Sign Units = 293)
1. Description of another activity	2	3
2. Paralleling elements of two activities	5	8
3. Comparison of two activities	28	92
4. Contrasting two activities	28	108
5. Evaluation of the activity	26	82

Figure 1. *Distribution of the classes of signs used by the trainee teachers.*

Table 4
Referentiality Items Used by the Trainee Teachers to Relate the Viewed Activity to
Another One

Referentiality Items	No. of Teachers Using the Reference (TTs = 30)	No. of Sign Units in Which Referentiality Item Used (Sign Units = 293)
1. Own activity	29	111
2. Another viewed activity	22	39
3. Activity of colleagues	8	11
4. Characteristic activity of teachers	13	31
5. Exemplary activity +/-	26	79
6. Student activity	2	3
7. Characteristic activity of students	10	16
8. Activity prescribed by a teacher mentor	3	3
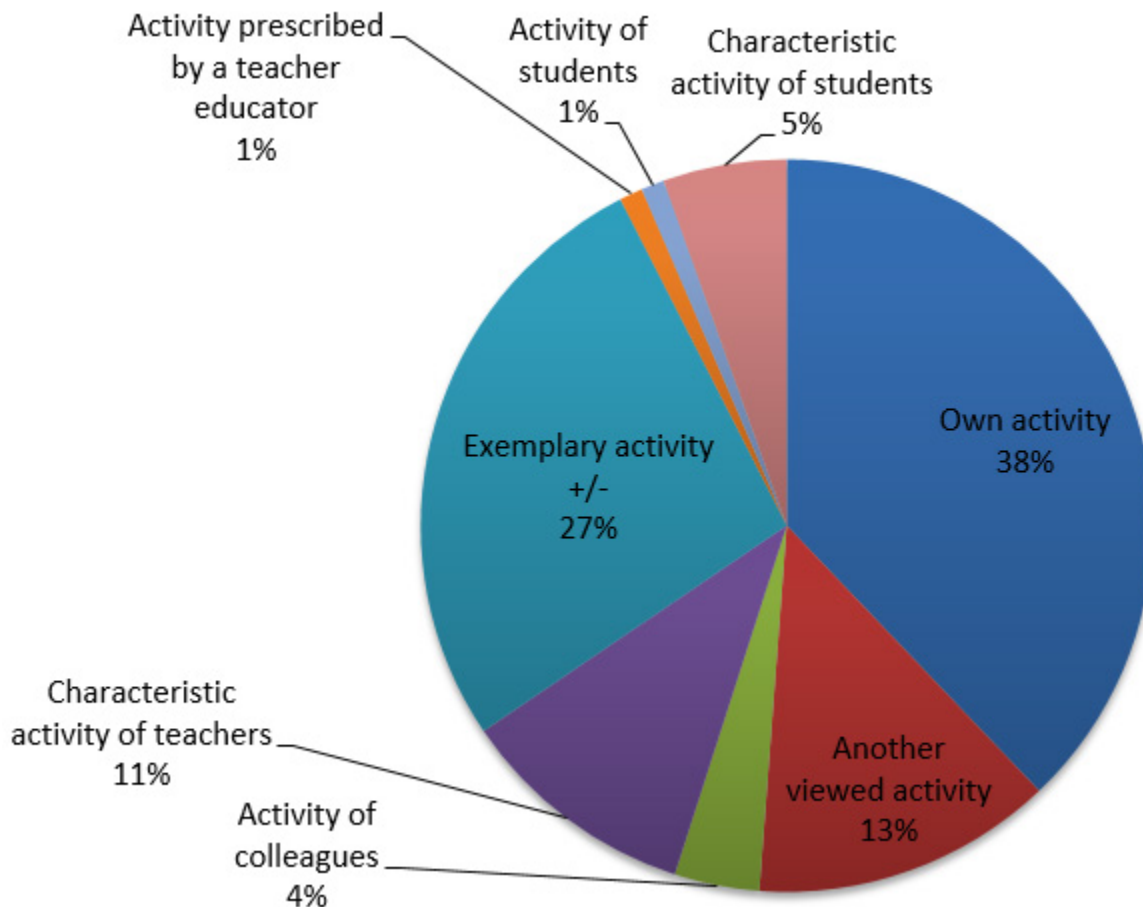
Figure 2. *Distribution of items of referentiality used by the trainee teachers.*

The results indicated eight types of activity that the TTs referred to in relation to the viewed activity.

Own Activity. The TTs viewing the video excerpt referred to their own activity (e.g., "When I raise my voice or shout, it doesn't work."). This reference was made by nearly all TTs and, thus, was most represented, accounting for more than one third of the references.

Another Viewed Activity. The TTs viewing the video excerpt referred to another video excerpt that they had viewed, usually from an earlier session in the module (e.g., "I think this is good [the viewed activity]. It contrasts nicely with the young teacher who asked a student to put away his stuff in the video I saw the last time.").

Activity of Colleagues. The TTs viewing the video excerpt referred to the specific activity of one or several colleagues observed in their classes (e.g., "My mentor is really expressive. She moves around a lot and everything. I don't think that she has much of a problem with discipline: Her students adore her.").

Characteristic Activity of Teachers. The TTs viewing the video excerpt referred to a certain general type of the activity of teachers (e.g., "She's managing this situation in a really calm way, and that's not the case for most teachers.").

The three types of reference to the activities of others made up about one third of the TTs' references. References to another viewed activity made up more than two thirds of their references. In comparison, the specific activity of colleagues was mentioned by eight TTs, making up only 4% of the references. The characteristic activity of teachers was brought up by only half of TTs, but they referred to it often.

Positive or Negative Exemplary Activity. The TTs viewing the video excerpt referred to an activity that they considered exemplary, either in a positive or negative sense ("I'm not a fan of calling attendance like that because it's a waste of time, where the students do nothing.").

References to exemplary activity were as frequent as references to the activity of another, whether specific or characteristic. Almost all TTs referred to such activity.

Student Activity. The TTs viewing the video excerpt referred to the activity of one or more students other than those being viewed (e.g., "My students have a hard time getting down to work.").

Characteristic Activity of Students. The TTs viewing the video excerpt referred to a certain general type of student activity (e.g., "It's true that most of the time the students are around people who aren't really sticklers for the rules on classroom behavior. So every time, it's like they've just landed on Mars.").

These activities were rarely mentioned by the TTs (two references to specific activities, 10 to generic activities) and accounted for only 6% of the activities used as references.

Activity Prescribed by a Teacher Educator. The TTs viewing the video excerpt referred to an activity that had been prescribed (e.g., "My supervisor told me, 'Yeah, you say something and you stick to it; otherwise you're lost for the rest of the year.'").

These activities are anecdotal: Three TTs referred to them, and they represent only 1% of the items of referentiality.

In summary, we observed that references to student activities (specific and characteristic) were marginal, as were the references to the activity prescribed by an educator. Most of the activities referred to by the TTs were distributed as follows: their own activities, the activities they consider exemplary, and the activities of others. The activities of others were either viewed on video or live in the classroom and were either specific or characteristic.

Discussion

The aim of this study was to gain a deeper understanding of TTs' experience while viewing video excerpts of unknown peers. We built on a robust hypothesis based on previous studies: video observation of peer activity prompts TTs to reference other activities, which raises questions about the usual distinction between noticing, interpretation, and reflection. This result is consistent with previous findings that viewing typical peer activities (such as those shown in the TT training module) is a significant experience that the TTs recall as a reference when analyzing another viewed activity. The study thus sought

to gain insight into referentiality by mobilizing five classes of signs and distinguishing eight items of referentiality. The findings pointed to issues that merit further investigation for instructional design, facilitation, and research.

Concerning the five classes of signs, the results show that the signs were distributed into three classes almost exclusively and equally (comparison, contrasting, and evaluation), and only a few into two classes (description and paralleling). This result agrees with previous findings that viewing video excerpts from unknown peers in a training context with an open think-aloud protocol generates mostly value judgments. This finding seems to indicate that viewing videos of peer TTs elicits a form of resonance — that is, the TTs recognize the observed situations and identify with their peers (Brouwer, 2014; Goldman, 2007).

This result underlines the relevancy of linking to observed and recalled activities. The finding can be explained by the open think-aloud protocol, which had no instructional purpose: The TTs expressed themselves according to an "ordinary semantics of action" (Ricoeur, 1977) that is inherently normative and defined by personal goals as, typically, TTs are motivated by the need for practical solutions (Huberman, 1989). Gaudin et al. (2014) also reported this result and showed that this personal inclination in observation remains even in prescriptive instructional designs.

Considering the eight items of referentiality, the results show that they were variably distributed. We observed a strong referentiality of the TTs to their own activity (38%) and suggest three explanations. First, TTs, in general, tended to focus on themselves and solving their immediate problems. This preoccupation confers on video observation a role greater than that of a window on peer activity: It functions as a mirror — and partly distorting at that — on the TTs' own activity (Flandin, Leblanc, & Muller, 2015; Miller & Zhou, 2007).

Second, the absence of a defined instructional goal puts the TTs in a situation of self-education and, thus, encourages the referencing of elements of their own activity. Third, the video excerpts they viewed are typical of the activity of novice teachers, which encouraged them to project themselves into closely related but not identical situations — into situations resembling those personally encountered — that too close or too distant a proximity would not allow for (Lussi Borer & Muller, 2016; Santagata & Guarino, 2011).

We also observed a rather strong referentiality to exemplary activities as the TTs viewed the video excerpt (27%). The prevalence of references to exemplary activity tends to reinforce the results indicating that TTs viewing video excerpts are quite spontaneous in making a high number of value judgments and expressing and explaining the norms and conceptions of teaching, especially in relation to the general rules of teaching. Our interpretation is that, in a situation of no instructional guidance, the TTs tended to directly evaluate the viewed activity against what they considered to be good or bad practice, based on their knowledge and beliefs. Strong guidance is thus necessary to tune TTs' attention to relevant aspects of the viewed activity (Santagata & Guarino, 2011; Sherin & van Es, 2009).

Indeed, a triad of the viewed activity, their own activity, and a set of exemplary activities was mainly mobilized by the TTs (65% of the cumulative items), while other items emerged more episodically (35% of the cumulative items).

Other activities that the TTs had observed on video were fairly frequently mentioned (13%). This result was expected as the study took place at the conclusion of a module based on video observation: the continuity of video observation seems to have sharpened the TTs' habits of perception and interpretation. It also indicates that the module offered them

significant experiences mediated by the video and that these experiences were recalled as items of referentiality for later interpretations.

Two results are surprising: Low referentiality to student activity and low referentiality to activities prescribed by educators. This result is consistent with the research showing that teachers at the beginning of their careers spontaneously focus their observations on teachers' activity, which is more meaningful to them than that of students (Leblanc & Ria, 2014).

The low referentiality to student activity (6% of the cumulative signs) is comparable to the referentiality to the activity of colleagues (4% of the signs)—which, conversely, is unsurprising, given the few opportunities TTs have to observe their peers in their classrooms. The low referentiality should be put into context, however, as the observed teacher's activity was in great part made up of interactions with students.

Nevertheless, student activity as a distinct reference was little mobilized in the TTs' observation and experience. Again, this can be explained by TTs' tendency to focus on themselves and the practical solutions directly borrowable from the observed peer. Also, the video excerpts seen in the module were very much centered on the teachers and the space immediately surrounding them to facilitate the analysis of gestures, attitudes, and postures in classroom management. Few opportunities were left to focus on student activity in and of itself. More didactic videos on other academic issues with a greater focus on student learning would likely have shown more of the students and probably increased the referentiality to their activity.

The low referentiality to the activities prescribed by the educators (1%) is surprising, given the great amount of advice and instruction given by the university supervisors and mentor teachers over the course of the curriculum. Nevertheless, it is known that the knowledge that TTs construct and mobilize during their education is extensively reorganized during the induction period (König et al., 2014), and the TTs in this study were not encouraged to rely on prior knowledge.

These results highlighted new accountable categories of teacher video observation that need further qualitative and quantitative investigation. They also support several new instructional designs or those already proposed in the literature. In particular, they tend to promote designs that preserve the richness of teaching situations presented in video excerpts, at least initially, rather than those that remove elements of predetermined importance from the classroom context (Sherin, 2004). By preserving the integrality of an excerpt, it is possible to use video not only for what it can show, which is of course its main interest, but also as a way of stimulating TTs to link together many formative experiences that initially seem unrelated.

When used as a tool for linking the observed, lived, and imagined activities of teachers and students, video can contribute effectively to a major challenge in teacher education: synergizing all the educational contents (which are dealt with separately in the curriculum) to improve teacher education (Kennedy, 2016). Video used this way is particularly promising in the induction year, a period during which articulating theory and practice and transposing prior knowledge into intervention know-how is crucial. This is all the more difficult as the teaching profession remains in some respects a private activity, and novice teachers have little opportunity to see how their colleagues operationalize their knowledge (e.g., how they manage the individual and collective behaviors of their class), hence the interest of videos.

Concerning facilitation, the results indicate that if the objective is to encourage description and paralleling, the instructional design and guidance need to be particularly precise, whereas the classes of signs of comparison, contrasting, and evaluation are more spontaneously mobilized. Thus, encouraging TTs to mobilize different classes of signs and items of referentiality during video observation serves to multiply their modes and means of interpretation of teaching and, thus, maximizes their learning opportunities. Nevertheless, teacher educators need to understand these modes and the links between them, which is precisely the contribution of this study. Access to the value systems of TTs and their concepts of education is crucial for designing video-based education that can change teaching practices. The norms that TTs express in relating one activity to others contributes to a process of renewal of the rules to be followed in action, which is central to teacher change (Guskey, 2002).

To conclude, our results suggest the need to acknowledge the dimension of referentiality in video observation as a legitimate object of research, instructional design, and facilitation in the field of video-enhanced teacher education, especially during the induction year. Yet, no systematic study has been conducted to examine the processes that contribute to learning and how to promote them in teacher education. Pursuing research in this field is necessary, in particular, by describing the items of referentiality according to the reference mode (current, recalled, imagined, and characteristic), as this study has suggested the interest of doing so.

Another interesting research direction would be to continue the type of analysis carried out in this study by coding all the signs produced by the TTs — those referring only to the activity being viewed and those referring to another activity — in order to better estimate their respective and joint importance in the development of TT thinking. This research would extend the amount of knowledge in the field, particularly regarding understanding of how video can be used to affect the experiences and the observation and thinking processes of teachers learning to teach.

End Note

[a] Created in 1988 by the European Union, the ECTS (European Credits Transfer System) aims to facilitate the academic recognition of studies abroad, notably within the framework of the ERASMUS programme. The ECTS credit is proportional to the volume of work to be provided by the student and enables the level achieved to be measured.

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Appendix A

Peircian Semiotic Theory

According to Peirce, we access reality through the perception of the phaneron, which is composed of monads, dyads and triads. The monad belongs to the category of firstness. It is a general quality or a general possibility: sentiments and emotions are good examples. The dyad belongs to the category of secondness and it concerns the singular existence, the facts and events that are existent. The triad belongs to the category of thirdness, which refers to the union of two elements in a third element that mediates between them. With thirdness, facts become rules, laws or conventions.

On the basis of this phaneroscopy, a sign is defined as the triadic relationship between a representamen, an object, and an interpretant. The representamen is the sign itself, what represents. The object is what the representamen refers to, what is represented. The interpretant establishes the mediation between the object and the representamen.

Each of the three types of sign can be a first, a second or a third. A representamen can be a first, a potential sign (qualisign); a second, a real sign (sinsign); or a third, a convention, a rule, or a law (legisign). An object can be a first, a potential object (icon); a second, a real and existing object (index); or a third, a conventional symbolic object (symbol). An interpretant is a first when it interprets the relationship of an object to a representamen as a possible relationship (rhema), a second when it interprets the relationship of an object to a representamen as a real relationship (dicisign), and a third when it interprets the relationship of an object to a representamen as a relationship regulated by convention (argument).

From this triadization, we obtain ten classes of logically and hierarchically organized signs:

The Ten Classes of Signs in Peircian Semiotic Theory

	Representamen	**Object**	**Interpretant**
Rhematic Iconic Qualisign	1	1	1
Rhematic Iconic Sinsign	2	1	1
Rhematic Indexical Sinsign	2	2	1
Dicent Indexical Sinsign	2	2	2
Rhematic Iconic Legisign	3	1	1
Rhematic Indexical Legisign	3	2	1
Dicentic Indexical Legisign	3	2	2
Rhematic Symbolic Legisign	3	3	1
Dicent Symbolic Legisign	3	3	2
Argument Symbolic Legisign	3	3	3

Appendix B

Method of Construction of the Sign and of the Classes of Signs According to Peirce's Semiotic Theory

We identified all the remarks produced by the TTs and the ways of putting the viewed activity into relationship with another activity, in order to progressively build classes of the signs needed for coding. Thus, some of the comparisons were *neutral* in the sense that they drew parallels with other events of the same nature (e.g., "I sometimes have students that arrive late"). Other remarks were more *evaluative* (e.g., "Doing this with students of this age... it's irrelevant"). Still others sought to draw parallels regarding the intentions underlying a certain activity (e.g., "I try to speak softly to calm the students"). The difference between those remarks that compared two *raw realities* and those that were norm-based evaluative remarks refer respectively to the Peircian categories of secondness and thirdness. The remarks comparing intentions were between the two: the expression of possible thirdness. Although categorization was still provisional in this step, it was nevertheless sufficiently significant to make systematization relevant by constructing a sign of *the relationship of two activities.*

Construction of the sign:* the relationship of two activities *and classes of signs. This formal stage consisted in constructing the sign *the relationship of two activities* and constructing the different classes of signs in order to categorize the TTs' remarks. The sign *the relationship of two activities* was constructed as follows: the representamen corresponded to what was said, the object corresponded to the relationship between the activity viewed and another activity, and the interpretant corresponded to the mode of relationship (the order of possible, real, or rule) established between the first two.

Construction of different classes of signs. Since the comments produced are language, thus falling within the scope of a convention, the representamen can only be a third, or a legisign. Thus, from a logical viewpoint, only the following set of signs can be documented: 3.1.1, 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.3.3. To the extent that the object is the relationship between the viewed activity and another activity and these two activities are real (they exist), the object can only be an existent, and therefore it belongs to secondness, or it can be a rule and belong to thirdness, if this existent is *seized* from a normative point of view. Thus, from a logical viewpoint, only the following set of signs can be documented: 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.3.3. We constructed the classes of signs from the logically lowest class (3.2.1) to the highest class (3.3.3). (See Table 2.) This step proceeds as a purely formal undertaking and is not a categorization of empirical statements. Thus, signs other than those that formal analysis identifies cannot emerge from the data: logically there can only be signs belonging to the set of 3.2.1, 3.2.2, 3.3.1, 3.3.2, 3.3.3. On the other hand, although the signs produced are logically necessary, they do not necessarily have a proven existence in the empirical statements. At this stage, what is needed is to identify how one can logically describe the relationship between two activities, not what is said. This is an *a priori* analysis.

The first class of signs: Description of another activity (3.2.1). This sign is language (R = 3), as for the following signs. It refers to a real object (O=2), which is the relationship between the viewed activity and another activity, but nothing is said about this relationship and it thus remains *open* (I=1). Although there is an index-type relationship between these two activities — it is indeed during the viewing of activity A that things are said about activity B — this link itself is not the object of this type of sign.

The second class of signs: Paralleling elements of two activities (3.2.2). Like the previous one, this sign refers to a real object (O=2), which is the relationship between two activities, but in this case, it also informs about the relationship (I=2). The activity being viewed triggers the description of events similar to another activity. There is thus an index-type relationship between these two activities (O=2), but in addition something is said about the relationship itself: it is composed of similar elements or facts (I=2).

The third class of signs: Comparison of two activities (3.3.1). The passage from the index-type (2) to the symbolic (3) means that the comparison between two activities no longer refers to the similarity or difference between elements or facts, but points to the similarity or difference in the meaning of these activities in a significant form (O=3). Yet this comparison of the meaning of the activities is merely expressed and is not itself the subject of an interpretation (I=1).

The fourth class of signs: Contrasting the two activities (3.3.2). As for the preceding sign, the relationship between the two activities is captured at the level of their meaning (O=3). In addition, however, this comparison is interpreted as setting up a contrast, a competition (I=2): thus, one activity serves for judging the other.

The fifth class of signs: Evaluation of the activity (3.3.3). Here again, as for the preceding sign, activity as a significant form is contrasted with another activity (O=3), but this other activity is a general reference activity, either *good* or *bad* (I=3). In this case, the viewed activity is measured against a yardstick of general criteria, and not against the yardstick of another equally singular activity, as in the preceding sign.