Prepare-Participate-Connect: Active learning with video annotation

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Annotation of video provides students with the opportunity to view and engage with audiovisual content in an interactive and participatory way rather than in passive-receptive mode. This article discusses research into the use of video annotation in four vocational programs at RMIT University in Melbourne, which allowed students to interact with and learn from video-based learning materials. Four different practice models were used in the study where students analysed case-based and role-played scenarios to understand and develop workplace skills. The findings of the study show that while students were actively engaged with their videos and generally satisfied with their experiences, factors such as video suitability, individual versus team analysis, deep- or surface-level activities, and timing of intervention affected satisfaction and learning outcomes. The study analysed data relating to student use of video annotation through Rogow's (1997) learning process of prepare-participate-connect. This process provided a framework to ascertain the advantages and disadvantages of the ways that the four cohorts used video annotation. The findings of the study provide insights into video-based annotation practice, leading to the adaptation and expansion of Rogow's process for use in the tertiary education sector.

Introduction

Video provides an audiovisual learning medium that enlivens information and offers real-world examples with rich contextual detail. It provides students with repeat access to scenarios and information not always readily attainable in other forms. In education, an "ultimate goal of video analysis is to better comprehend and represent an individual or group's understanding of recorded events" (Rich & Trip, 2011, p. 21). Video without purposeful interaction runs the risk of providing a passive-receptive viewing experience. When used for content delivery in class or online, video should be accompanied with planned student interactivity plus time for critical reflection, concept description, collaboration and feedback loops (Laurillard, 2002). A study comparing simple and advanced video tools to support learning found that advanced video collaboration tools were more effective to facilitate understanding of content, development of cognitive and design skills, and the generation of efficient interactions (Zahn, Pea, Hesse, & Rosen, 2010).

The adoption of advanced video systems in education such as annotation tools requires effective teaching strategies. A media annotation tool (MAT) developed at RMIT University provided technology for video annotation by student groups. Students in this study analysed video content in MAT, and then anchored text to segments of video using coloured markers to categorise content and to articulate and share their analyses. These textual entries ranged from simple self-authored notes through to collaborative threaded discussions. Data was gathered regarding the use of MAT through pre- and post-surveying of students, analysis of interaction artefacts, and post-interviews/observations with both students and teachers. For this article, we analysed selected data from the study relating to four vocational cohorts of students that used MAT to assist in the development of workplace skills, such as communicating with clients or conducting a meeting. In order to establish the advantages and disadvantages of the various pedagogical approaches to using MAT, we analysed the data through Rogow's (1997) three-part process for video interaction: prepare-participate-connect. The findings provide insights into possible ways to improve practice in using video-based learning with annotation. Additionally, the data has led the authors to extend the process, building on the work of Rogow (and subsequently Greenberg and Zanetis, 2012), to assist tertiary teachers in the use of video annotation.

Video with annotation as interactive multimedia for learning

The advent of digital video has led to more tertiary students having access to audiovisual content, while tools to manage video have evolved (Nicholson, Syder, & Freeman, 1994) and continue to evolve. Zahn et al. (2010) found that the greater opportunity for student discourse provided by advanced video tools, with affordances for segmenting, editing and annotating, allow for deeper and more focused discussion and enhanced learning compared with video with general playback options. Two examples of annotation to video demonstrate how active and focused engagement is enabled by anchored commentary within pre-service teachers' professional preparation group activities. In the first example, van der Westhuizen and Golightly (2015) describe undergraduate geography education students recording their own practice in microteaching sessions and sharing with peers to receive feedback. Each group entered annotations at specific points along the video as freeform comments or feedback, using the tool VideoANT, to help prepare students for ensuing teaching placement experiences. In the second example, undergraduate physical education students annotated videos of their actual school-based practice (their own and those of peers in their group) and analysed their performance according to teacher-set and colour-coded analysis categories for beginning teachers within MAT (Colasante, 2011). Digital annotation allows for creative student interaction with video; interactivity that "represent[s] the learner's information gathering process … [layered] on top of digital materials [to] enhance the learner's thinking and understanding in the learning process" (Jayawardana, Hewagamage, & Hirakawa, 2001). This approach changes the learning experience from passive video viewing to active consumption (Jayawardana, Hewagamage, & Hirakawa, 2001) and thus promotes deeper learning. Examples of web-based video annotation tools with interaction features include:

- OVA (Open Video Annotation, http://www.openvideoannotation.org/)
- AAV (Annotating Academic Video, https://github.com/entwinemedia/annotations/wiki)
- VideoANT (http://ant.umn.edu/).

Such tools allow for each annotation to remain anchored to a segment of video. Further, extending anchored notation to enable conversation means fine granular analysis and multiple convergent conversations can occur (e.g., Colasante, Kimpton, & Hallam, 2014). This compares to general diverging video commentary enabled in tools such as wikis and Facebook. Students can categorise their annotations in MAT, which facilitates cognitive organisation of learning and focused discourse via threaded peer collaborative discussion at each annotation point. In an alternative approach, Risko, Foulsham, Dawson, and Kingstone (2013) introduced an annotation tool, CLAS, to aid students' revision of videoed lecture content via a social navigation mechanism. Students created and shared point-based annotations along the lecture-video timeline to indicate points of interest to return to, offering a more simplistic annotation compared to conversational/textual annotations. However, text annotations are not always complex. Student reflection on and analysis of video can occur at different levels. According to the acclaimed work of Hatton and Smith (1994) descriptive writing is not reflective writing, descriptive reflection takes on board at least one perspective or justification, dialogic reflection evidences a deeper exploration of issues, and critical reflection evidences awareness of multiple perspectives and contexts.

The value of video annotation is dependent on the pedagogical design underpinning integration of the technology. Merely including video annotation without due attention to the intended learning outcomes risks a focus on technology that fails to deeply engage students. Greenberg and Zanetis (2012) championed Rogow's (1997) "three-step process for enhancing the outcomes of video presentation in the classroom" (Greenberg & Zanetis, 2012, p. 30), adapting Rogow's interactive TV and video-based learning process for school children of prepare, participate, then connect to improve the use of digital video. Rogow's framework and Greenberg and Zanetis' adaptation are provided in Table 1.

Both Rogow's (1997) approach and Greenberg and Zanetis's (2012) adaptation are used in school level education. Rogow's approach can be further adapted for the tertiary sector, incorporating the use of video annotation in a range of teaching strategies.

Table 1
Three-step process to promote interactive video-based learning for school children

School children watching a video in class		
Steps	Rogow (1997)	Greenberg & Zanetis (2012, p. 30, adapted from Rogow, 1997)
Prepare	Let students know why they are watching, what to look for, or what you will ask when the video is over. The younger the student, the more detailed the description should be of what they are going to see.	Preview the program to be sure it meshes with teaching approaches and the class' learning goals. Determine the setting and length of the video: home viewing, in class, whole segments or clips. Set clear expectations for the students: be direct about the intended outcomes of viewing a particular video and the follow-up activities that will take place. Practice with the equipment and cue up the relevant portions to be viewed.
Participate	View interactively. Sing along, answer questions aloud as they are posed, pause to discuss possible outcomes or solutions before the video presents them, pause to check for comprehension, pause to predict action, write down clues, etc.	Preface the viewing with a few key questions and/or learning objectives. Pause video to flag important concepts and to allow for questions. Use captioning features to reinforce narrated information. Consider a second viewing, especially for younger children. Break students into small groups for discussion, or have them write down their thoughts and then share the results with the larger group.
Connect (to other activities)	Bring the video lessons off the screen and into the classroom or home by choosing follow-up activities that connect the viewing experience to hands-on exercises or real-life experience. With younger students, be sure to explain the connections between the video and the activities you do.	Choose follow-up activities that connect to hands-on experiences. Explain all connections made, especially for early-grade students.

Teaching strategies

In the 1990's, Nicholson et al. (1994) observed, "the scope for video-supported active learning is limited more by the limitations of one's imagination than the limitations of the technology" (p. 97). More recently, Pardo and colleagues noted, "there are few studies that investigate the connection between video annotation and student approaches to learning" (2015, p. 258). To support the achievement of intended learning outcomes, the vocational teachers in this study used two main strategies, case-based learning and role play, employing authentic contexts to promote the nexus between knowledge and skills. Case-based learning, building on descriptors by Bennett, Harper, and Hedberg (2002), offers two key factors: the case comprising rich contextual detail and the implementation or teaching design that supports the case. Both rely on the availability of cases and their suitability for the intended learning outcome(s). Role-played performance can be used in conjunction with authentic learning environments to provide students with the opportunity to develop real-world skills (Jones, 2006), including complex decision-making that incorporates diverse and competing perspectives (McLaughlan & Kirkpatrick, 2009).

Well-planned guidance to interact effectively with a video case can be incorporated into video annotation tools, for example:

> [To allow] learners to compare a new situation to previous experiences, by looking for matching characteristics and then adopting old solutions to create a new one. In order to

> successfully retrieve previous cases, learners must label (or index) them appropriately at the time of learning. (Riesback, 1996, cited in Bennett et al., 2002, p. 3)

Annotation tools provide the means for students to actively label and index video cases. Examples of video used to present real-world cases for student annotation include pre-service education students analysing both video cases of experienced teachers' practice (Zottman et al., 2013) and school children tackling mathematical problems (Rich & Hannafin, 2009); and chiropractic students analysing chiropractic clinical episodes to stimulate clinical thinking processes (Colasante et al., 2014).

Although discussion is available on video annotation of student performance (e.g., Colasante, 2011; van der Westhuizen & Golightly, 2015) and video analysis of role play (e.g., He, Mackey, O'Brien, Ng, & Arthur, 2011; Kuter, Altinay-Gazi, & Altinay-Aksal, 2012), references to video annotation of role-played performance are scarce (apart from Colasante & Leedham, 2013, a precursor to this paper). However, the Kuter et al. (2012) study of simulated teaching practice provides an example of video analysis not dissimilar to structured analysis that video annotation tools can facilitate. The students analysed their own and peers' teaching using an appraisal form and lesson plan to guide objective and structured video analysis, to achieve reflection on simulated practice and professional growth.

Methodology

The project sought to examine the role of MAT in learning experiences across tertiary sectors and nine different industry disciplines, four of which from the vocational sector form the focus of this paper. The aim was to use MAT to enhance work-relevant learning and enable industry collaboration. Examination was by multiple-case study, with outputs to inform models of practice. University ethics approval was granted to conduct the research. Pseudonyms are used in this paper.

Three research questions are addressed in the findings (1, 2) and the discussion (3):

(1) How did the four vocational case study cohorts use MAT in their learning and teaching?
(2) How do these practice models align to a prepare-participate-connect learning process?
(3) What can be learnt from the practice models emerging from the data sets?

Case selection and contexts

The vocational cohorts in this study comprised one group of students undertaking studies in audiovisual technology (AV) and three groups in property services (PD, PT, PO). Audiovisual technicians are responsible for audiovisual hardware needs in an enterprise including operation, production, installation, design and maintenance. Property services personnel manage and/or maintain facilities such as public buildings and multi-owner residential complexes and may be involved in building inspections, financial management, and real estate and strata management. Basic demographics in the pre-survey showed the gender mix was almost even for the PO cohort while the three remaining cohorts were predominantly male. The age range responses reflected typical post-secondary age for audiovisual technology students compared to the property services students who were more mature-aged.

The cases reported in this paper were selected purposively for their use of MAT in the common contexts of vocational study for workplace skill development and at Australian Qualification Framework levels of AQF-4 (certificate IV) and AQF-5 (diploma) (Australian Qualification Framework Council, 2013). The cases shared commonalities (literal replications) as well as contrasting conditions (theoretical replications) (Yin, 2014). The common and contrasting contexts are discipline (property services/audiovisual technology); learning approach (team/individual; case-based/role play) (see Table 2). This combination offered the opportunity to go beyond providing four descriptive single-case studies to consider cross-case findings, notwithstanding Yin's suggestion (2014) that further related case studies would be required to establish "an excessive degree of certainty" (p. 61).

Table 2
Contrasts across the vocational cohorts

Cohort		Learning approach		Video content
AV	Audiovisual Technology (Diploma)	Case-based learning	Individual	Acted customer experiences
PD	Property Services (Diploma)		Team-based	Senior industry representative interview
PT	Property Services (Certificate IV traineeship)			Multiple industry representative interviews
PO	Property Services (Certificate IV specialised for owners corporations)	Role play		Student role-played industry-styled meetings

General learning tasks

One group of property services students analysed student-generated videos of their own role plays of work-relevant experiences. The remaining cohorts analysed case studies either of interviews with industry representatives or commercial videos enacting workplace scenarios. The students reported general satisfaction with the MAT interventions with indicators to further investigate factors affecting satisfaction (as reported previously, see Colasante & Leedham, 2013).

Videos were uploaded to MAT, and each cohort was given class time to log in and analyse the videos online. Students could also log in via external computers to complete activities, as the web-based platform was not reliant on particular software other than Flash®. The video-based learning approaches are summarised in Table 2, and further details are provided later in the model descriptors (findings).

Students analysed their videos according to the instructions provided by their respective teachers and the teacher-set analysis categories created in MAT. To create each video annotation (see MAT interface in Figure 1), students added a marker (B) to the relevant section of the video timeline, selected a marker type (A) from various teacher-defined categories, and entered a title of their choosing (C) and notes (D). Where MAT was set to enable small group work (all except the AV case), peers within their group could view/read each other's annotations and enter reply comments in threaded discussions (E). In the PO example shown in Figure 1, over a dozen markers were created across the video timeline by one group of students.

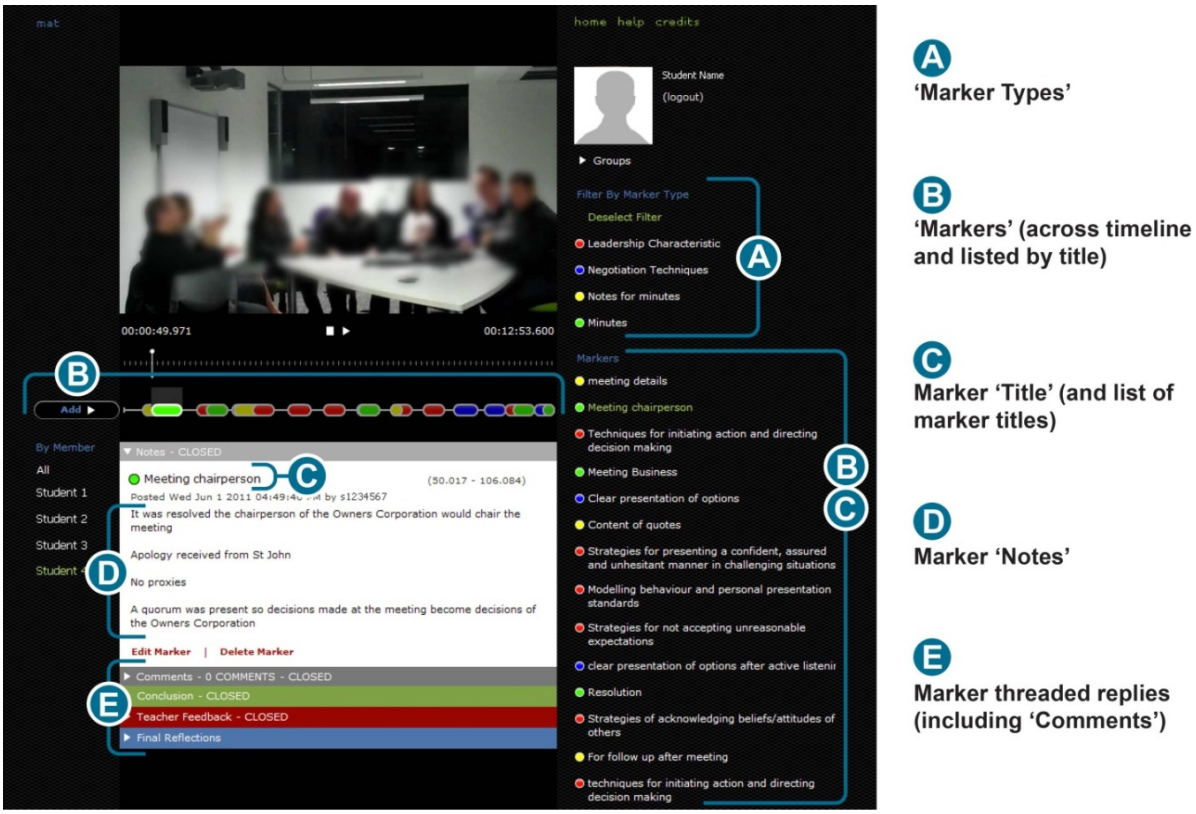


Figure 1. Image of the MAT interface, as used by a group in the PO cohort (de-identified; label overlays)

Data collection and analysis

To gain enriched perspectives of the cases, the multiple-case study employed qualitative and quantitative data collection methods, with instruments that were pre-tested in a pilot-case study (see Colasante, 2011). Students were invited to complete a survey in two parts: a questionnaire before using the new tool and another afterwards. The pre-survey collected demographics and attitudes towards online learning, although the latter is not reported on in this paper. The post-survey questioned attitudes of and experiences with the video annotation activities and thus helped answer research questions 1 and 3, and ultimately question 2. Both students and teachers participated in individual *interactive process interviews* (IPIs), or audio-recorded observation and semi-structured interview sessions. The first 10–15 minutes involved observation/demonstration while using MAT and think-aloud protocol, where participants voiced their thoughts about MAT as they used the technology. This was followed immediately by 10–15 minutes of discussion about their experiences using MAT in an interactive interview format (for further detail on IPIs see Colasante, 2011). All IPIs were audio-recorded with permission from participants and professionally transcribed. In each vocational case, the MAT activities had concluded by the time of interview; therefore, participants were asked to demonstrate their MAT activities. This resulted in a deviation from direct observation and thinking-aloud without distraction or disruption from others, to describing and demonstrating activities (Ericsson & Simon, 1998). Additionally, student and teacher participants were invited to allow MAT-related learning and assessment artefacts – besides general/overall statistics of MAT interactions – to be used for purposes of the study such as individual annotations in MAT and teacher instructions of consenting individuals. The IPIs and the artefact analysis provided a range of direct and indirect observational data contributing towards answering research questions 1 and 2, plus perceptions on experiences from the IPIs contributing to question 3. Table 3 gives the participation numbers for this data collection range.

Data analysis involved using SPSS to initially process quantitative survey responses and Excel to form comparative graphs. NVivo was used to organise qualitative data from open-response survey questions and IPI transcripts into general themes, prior to coding the data to preparation, participation and connection. Learning analytics included a complete sweep through MAT to collect general participation statistics for each of the cases, and deeper capture of learning activities of only consenting individuals. Such fine-grained learning analysis data can be purposefully grouped to provide evidence of learning engagement and progress (Bienkowski, Feng, & Means, 2012), providing illustration of and grounding for analysis of other data.

Table 3
Student participation levels in the study

Case	Class size	Pre-surveys completed	Post-surveys completed	IPI participation			Artefact analysis consent
				Students	Teachers	Teacher assistant	
AV	39 (22 MAT active)	18 (46%)	13 (33%)	1	1		15 (38%)
PD	22 (16 MAT active)	13 (59%)	5 (23%)	1			3 (14%)
PT	20 (17 MAT active)	8 (40%)	10 (50%)	2		1	6 (30%)
PO	29 (21 MAT active)	20 (69%)	9 (31%)	2	1		4 (14%)
Totals	110 (76 MAT active)	59	37			9	28

Each case study ranged in size from 20 to 39, with a sum of 110 enrolled students (see Table 3). Not all students were active participators in MAT, as evidenced by general learning analytics. Student research participation rates ranged from 23% to 69% for the surveys and 14% to 38% consenting to detailed artefact analysis.

Analysis of four practice models (findings)

The four vocational models of MAT integration are presented within a framework of (a) prepare, (b) participate and (c) connect, reflecting Rogow's (1997) learning process for interactive viewing (refer Table 1), followed by survey responses regarding learning and interaction benefits. The findings answer research questions 1 and 2. For the sake of brevity the PD and PT cases are presented together (given their like practice models) while still exhibiting their differences and respective findings.

AV model

The AV student cohort, Diploma of Audiovisual Technology, studied the subject, Quality service, over one semester. Video analysis was used to ascertain and standardise understandings of quality service skills prior to role play activities.

Prepare

Besides planning, technical support teacher preparation towards the learning objective, to provide quality service to customers, primarily involved setting a range of conditions in MAT to enable the intended learning. These included selecting and uploading two commercial video cases, one set in a library, another in general businesses (e.g., hairdresser, video store); creating 12 skill/analysis categories, as adapted from performance criteria (vocational learning outcomes) for the subject (e.g., Recognise customer dissatisfaction promptly and takes appropriate action); and posting activity instructions.

Participate

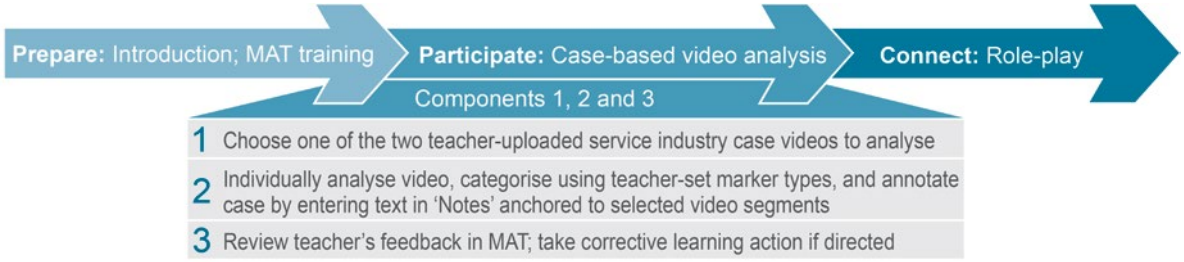


Figure 2. AV practice model

Figure 2 presents an overview of student participation. Students were instructed to identify 12 specific workplace skills in a video case and create a minimum of one annotation for each. When that activity was completed, the posted instructions were updated to inform students that teacher feedback was available in MAT.

Artefact analysis shows that students preferred the video on general business customer service. The teacher interviewed suggested that it offered more opportunities for alignment with the skill categories. By activity end, students created on average 17 annotations each (range: 1–20). Sometimes they created multiple markers for one skill (shown by the multiple red markers on the video timeline in Figure 3), therefore going beyond original instructions for categorisation of the video. Artefact analysis of the text entries reveals either basic descriptive notes on their chosen video segments (like Figure 3) or descriptive reflections on what the identified behaviour portrayed in a quality service sense.

Figure 3. AV student annotation example (de-identified)

Teacher feedback was provided to each student on their overall video analysis, rather than feedback for each annotation. The AV teacher explained that the activity was relatively simple and the time commitment of providing further feedback would have been excessive.

One post-survey question asked AV students what (related to MAT) was most helpful to their learning. Some responses included:

> Being able to notate video at relevant spots; getting teacher feedback from my work
> Being able to reflect on my knowledge and understanding of customer service

> The continual combing through the video brought a heightened level of analysis and forced the mind into finding appropriate markers for the situation

Not all students were satisfied with the content of the videos. A post-survey question asking what (related to MAT) was least helpful to their learning elicited responses such as:

> Some of the video examples were unrealistic and vague.
> The content wasn't a very good choice for the subject we were undertaking.

Connect

The learning from AV MAT activities was applied to a role play that the students later acted out in class. Understandings to take forward from the topic content were facilitated by teacher feedback within MAT. Where students did not demonstrate adequate understanding of the skills, they were asked to repeat the activity (usually a second attempt using the alternative video). Repetition helped students construct a satisfactory knowledge base before they were required to apply the skills in the role play. The subject was one of the last the students completed in their program of study before they were ready to enter the workforce. Some students noted the theory-practice linkage, for example:

> To recognise [in the video] when certain kinds of … strategies for dealing with conflict … [in] customer services were being used. To then be able to replicate that [later] when in a customer service kind of role. (AV student IPI, Pearl)

Survey responses to AV model

AV post-survey responses gave more agreement than not regarding MAT activities helping students to analyse and achieve knowledge aligned to the intended outcomes (46%–62% agreed or strongly agreed). Approximately one-third was undecided and a minority (8%–23%) disagreed (Figure 4). That fewer than half agreed that MAT helped them to understand key concepts of communication may indicate the need for deeper comparative or critical reflection activities.

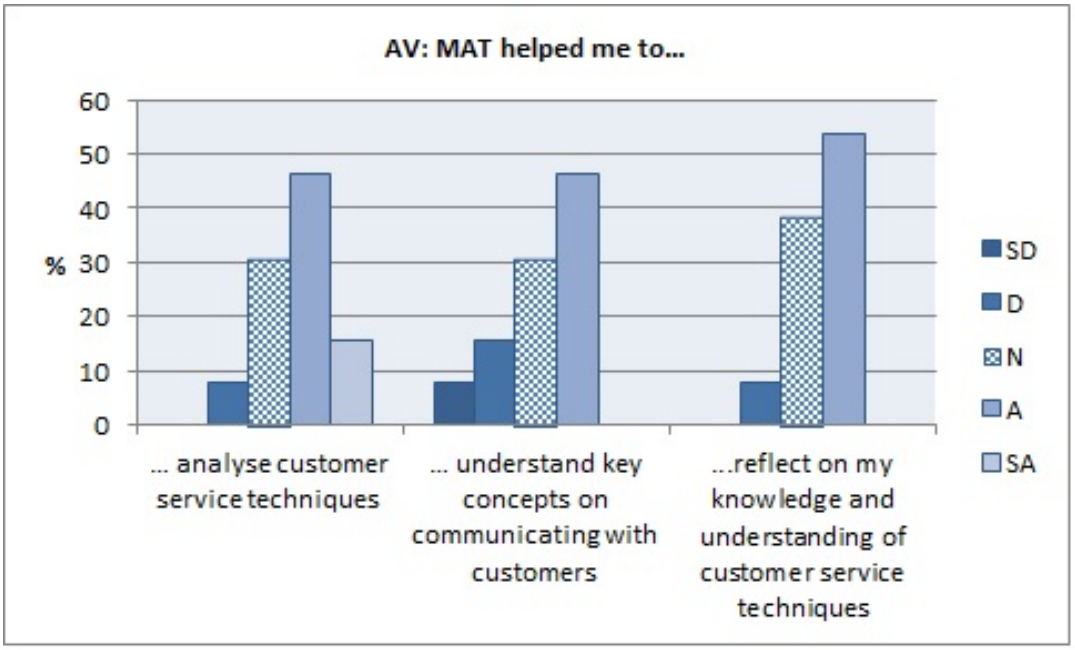


Figure 4. AV post-survey: MAT activities facilitating intended learning

The AV students were the only cohort with individual activities in MAT rather than teamwork. Therefore, fewer were satisfied with interaction with their peers (39%) compared to with their teacher (62%), who had given feedback to each student in MAT (Figure 5).

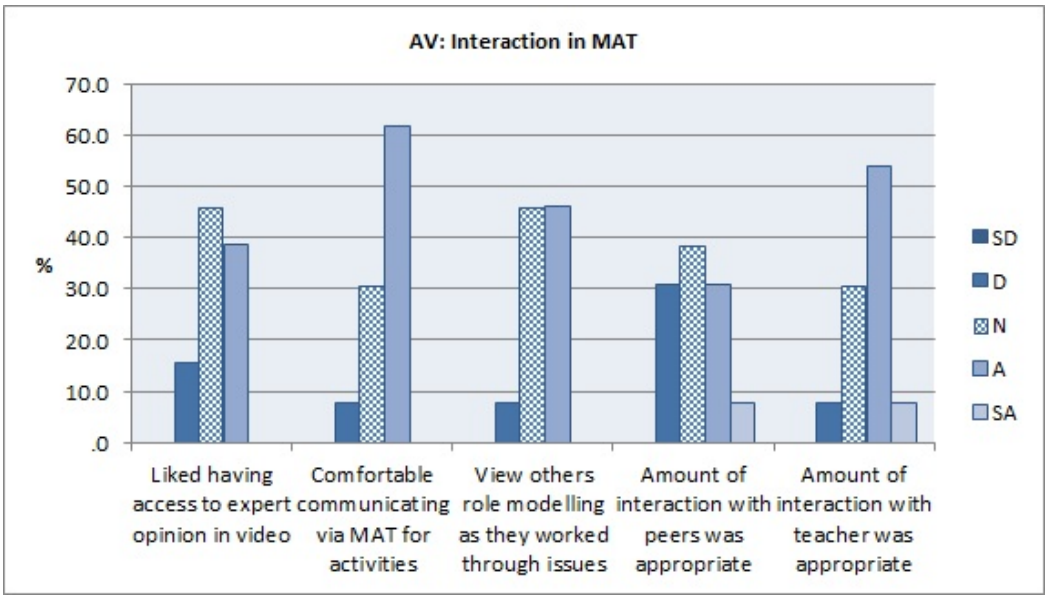


Figure 5. AV post-survey: MAT interactions

Across the remaining questions in Figure 5, it appears that while the students reported comfort in communicating through MAT, there was ambivalence in other areas. Fluctuations on access to expert opinion align with some dissatisfaction with the videos, as noted earlier. Uncertainty on role modelling also related to this issue, coupled with no access to peers' analysis in MAT. However, other respondents were able to find a way to engage with the videos, for example, "to work through each point and think laterally and use your imagination for some of the customer service points" (AV post-survey comment on advice for other students).

Diploma of Property Services (PD) and Certificate IV Property Services Traineeship (PT) models

For brevity, two property services cohorts are presented together due to their similar discipline and pedagogical approaches.

The purpose for the MAT activities for both PD and PT was to apply and consolidate theory from a cluster of subjects. The clusters were paced over several weeks (on- and off-campus study), however, for the PD cohort the MAT activities were condensed in two final face-to-face classes.

Prepare

Preparations to facilitate students achieving the respective objectives involved designing learning for theory classes, technical support for MAT, and setting MAT to enable the intended learning. The learning objectives were:

- PD: Coordinate customer service activities in the property industry; Manage relationships/networks in property services
- PT: Implement customer service strategies in the property industry, Establish networks, and in part Manage conflict and disputes in the property industry.

The PT model mirrored PD – including that both were organised into small groups in MAT – except three videos of experts from various companies were alternated across the PT groups while a single video of an expert was used for the PD groups. In addition, the PT groups compared and contrasted their analysis work to another group's video case analysis in MAT, and absentees were offered support including in and outside class-time options and/or given alternative assessment tasks. The PD cohort did not have time for these additional learning supports. The teacher's use of the single video for PD was to facilitate a comparison between issues raised in the video interview with a "high level manager" and students' own workplaces (PD teacher IPI, Patrick).

Four analysis categories were aligned to the PD curriculum (customer service feedback methodologies, relationship building, communication, negotiation), and six categories for PT (network strategies, customer service strategies, relationship building, communication, negotiation, recording (i.e., record keeping).

Participate

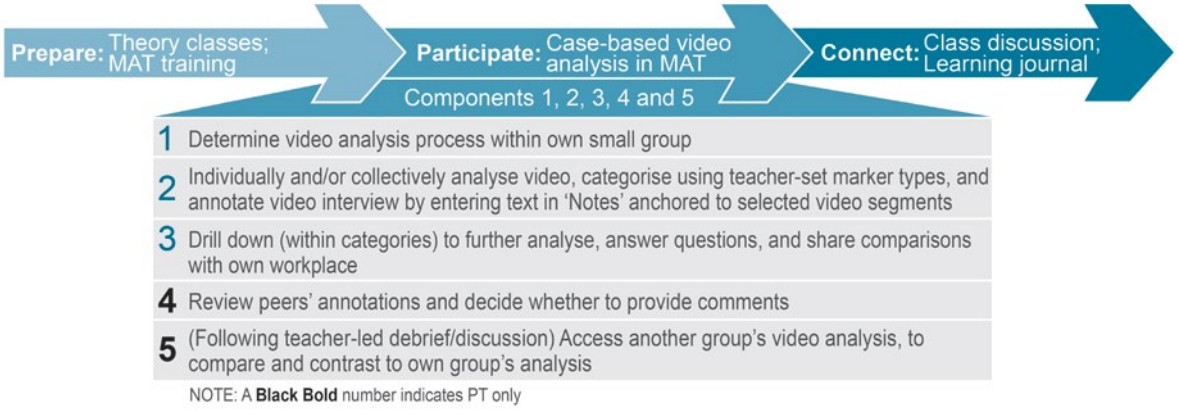
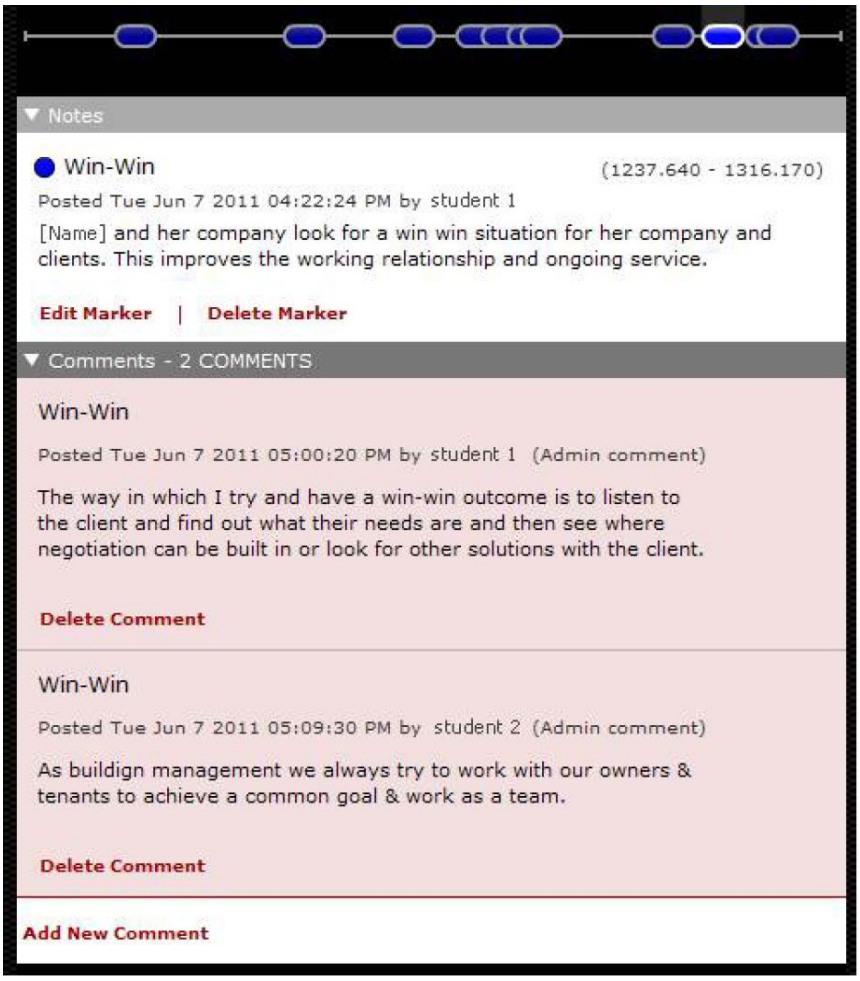


Figure 6. PD/PT practice models: commonalities plus additional components for PT

Figure 6 presents an overview of the participation activities. Components 1–3 formed the PD participation elements and 1–5 for PT. Activity instructions were provided as part of the subject's learning guide, comprising:

- Phase 1 "Create a MAT Footprint": Broad segmentation and labelling of skills in video
- Phase 2 "Expand your MAT Footprint": Further annotation/Insert sub-markers and make comments
- Phase 3 (PT only) "MAT Peer Review": Reflect, analyse and compare.

In the first MAT activity following theory classes (Phase 1), instructions detailed expectations of teamwork and self-management for groups (including work division and efficiencies) to identify skills in the video that corresponded to the analysis criteria. The second activity (Phase 2) required video mark-up at a finer granularity. PD groups were asked to create notes under the relationship building category in response to a set of questions that prompted further unpacking of the industry representative's skills, and eliciting comparison/application to the student's own workplace. By activity end, PD students had each created an average of seven discrete markers (range: 2–14 excluding threaded/reply comments) with 116 created by 16 active students. Example annotations illustrate student participation: Figure 7 shows two PD students interacting to meet Phase 2 goals.



Video:
Interview of senior industry representative

Group: A

Skill category:
'Relationship building'
(Blue marker type)

Title:
"Win-Win"

Notes:
"[Name of expert] and her company look for a win win situation for her company and clients..."
(authored by one student)

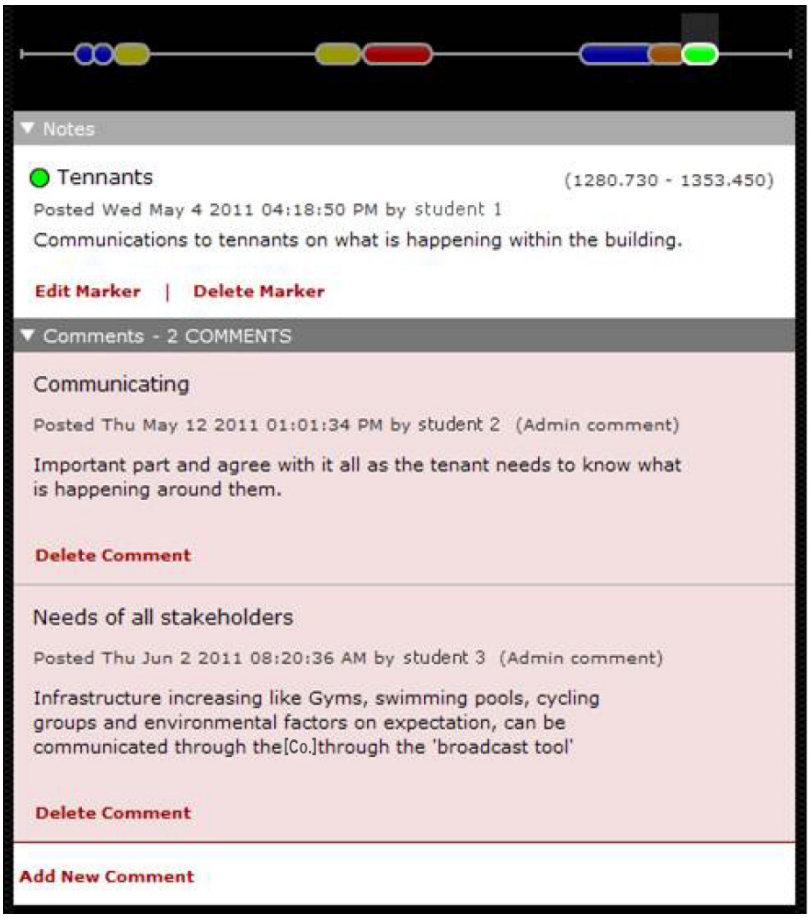
Comment (1):
"The way in which I try…"
(authored by same student)

Comment (2):
"As building(sic.) management we always try …"
(authored by another student)

Figure 7. PD student annotation example (de-identified)

Each group in the PT cohort similarly analysed their video cases, albeit they unpacked skills they had identified within the categories of networking strategies and customer service strategies. Following class debrief, the teacher extended access in MAT so each PT group could view another group's analysis of a different interview. Each group member was to reflect, analyse and compare their own thoughts on networking and customer service to those offered by an alternate interview analysis, and add comments to annotations on the new video regarding: Do you agree/disagree? Why/why not? This was supported by prompts to review online subject resources. By activity end, PT students had each created on average nine discrete annotations (range: 1–16 excluding threaded/reply comments) with 149 created by 17 active students. An example of students participating is offered below (Figure 8). It illustrates phases 1 and 2 video annotation activities.

Both the PD and PT example annotations (Figures 7 & 8) illustrate fairly typical notes at descriptive through to descriptive reflection level on their chosen video segments, with occasional dialogic reflections. This tends to align with the instructions provided to the students.



Video:
Second interview (of three)

Group: E

Skill category:
'Communication'
(Green marker type)

Title:
"Tennants" (sic.)

Notes:
"Communications to tennants…"
(authored by one student)

Comment:
"Important part and agree…"
(authored by another student)

Comment:
"Infrastructure increasing…"
(authored by a third student)

Figure 8. PT student annotation example (de-identified)

One PT student explained in interview how he sought video content and peer entries for comparison to his own understanding:

> In relation to contractor and client, it's all a knowledge base and just another set of eyes and I think it's very helpful that you can comment on other people's work or you can look at their comments and say "oh yeah, I see where that person's coming from". And it's just developing that knowledge base, I love this technology. (PT student IPI, Nathan)

Another PT student appreciated the colour coding of the analysis categories to facilitate review after annotation by filtering for a particular coloured marker (PT student IPI, Plato).

Connect

PD students had limited connection opportunities due to looming subject completion. This included a teacher-led, MAT-open, compare-and-contrast debriefing session, although not all equated this with feedback or feed forward opportunities, for example, "No feedback as it was the last lesson" (PD post-survey response). One of the students described interconnection between MAT and class activities:

> As a class we went through each of the sections and read out aloud, and the idea was to take on-board what others would say about what your comments were … and to make a note about it afterwards … taking on-board what others said but also being true to what I've written previously. (PD student IPI, Jonathon)

PT students had more connection opportunities, essentially looping through participate-connect a second time. After comparing their video analysis to their own workplace experiences and with other students' experiences an in-class debrief was held, followed by review of and contribution to another group's video case analysis. The final assessment activities for both PD and PT comprised documentation of learning from MAT activities contributing to their learning journal/portfolio.

Survey responses to PD model

PD post-survey responses depict majority agreement (60%-100% agreed or strongly agreed) on questions related to MAT activities helping students analyse and achieve knowledge aligned to intended outcomes (Figure 9).

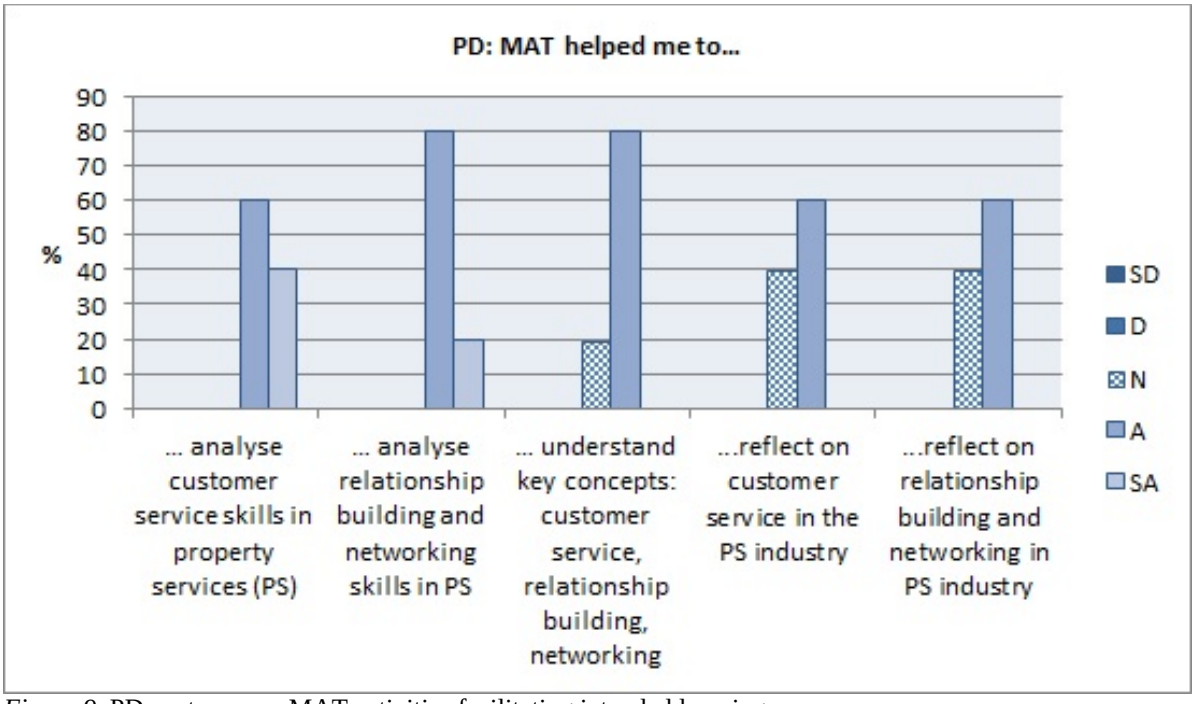


Figure 9. PD post-survey: MAT activities facilitating intended learning

Communications with others in the MAT environment were also viewed largely positively (60%–100% agreed or strongly agreed), apart from interaction with peers (40% agreement). The use of MAT in the final weeks of the course may have inhibited extended interactions between peers (Figure 10).

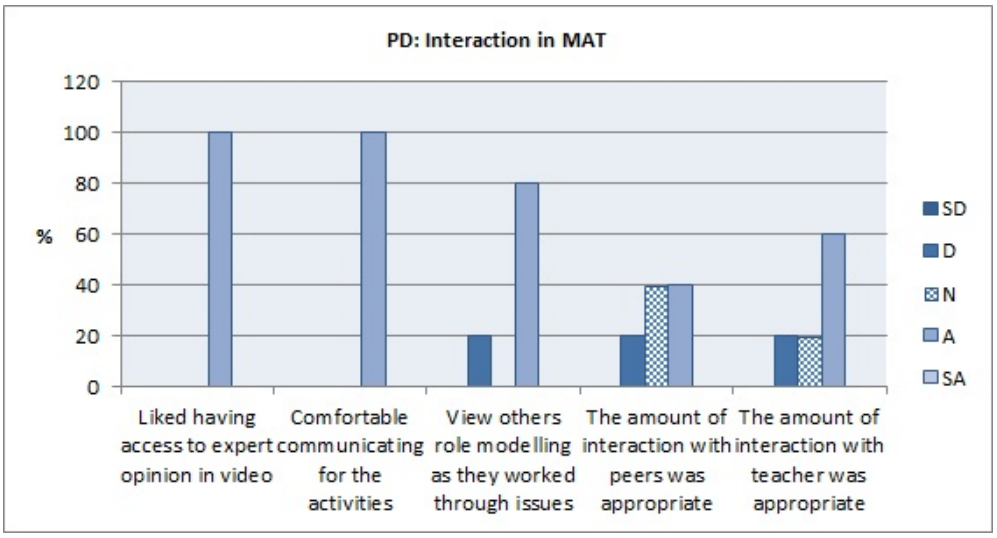


Figure 10. PD post-survey: MAT interactions

Example PD student responses in the post-survey to what MAT activities were helpful to learning included:

> Using markers during media activities helps to revisit and provide an accurate account when answering questions.
> Being able to see a video, stop it along the way, make comments, review comments from other students

Survey responses to PT model

PT post-survey responses gave majority agreement (50%–60% agreed or strongly agreed) on questions related to MAT helping students analyse and achieve knowledge aligned to intended outcomes (Figure 11). Questions that included the term networking tended to raise some disagreement (20%-30%), indicating the need to ensure adequate coverage of networking in the video, or investigate other possible learning barriers.

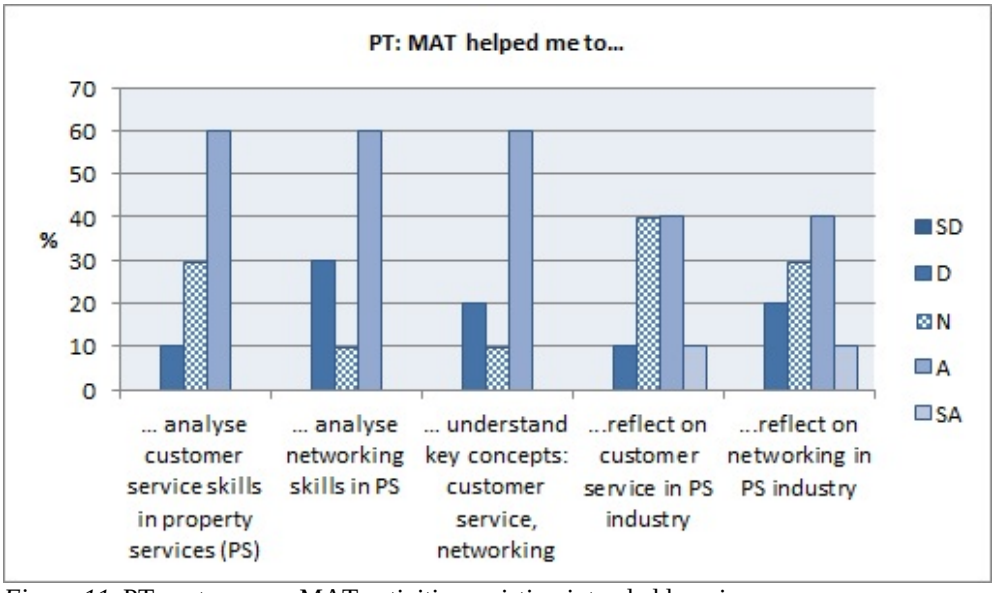


Figure 11. PT post-survey: MAT activities assisting intended learning

Contrasting views were noted regarding interaction in MAT (Figure 12). A majority appreciated access to the industry representatives via the video cases (70%), and reported appropriate amount of interaction with the teacher (60%). Some less positive responses may have been affected by difficulties interacting with the technology as noted in the PT post-survey, for example, "Many technical and access issues; My access worked on the first day, others weren't set up correctly though."

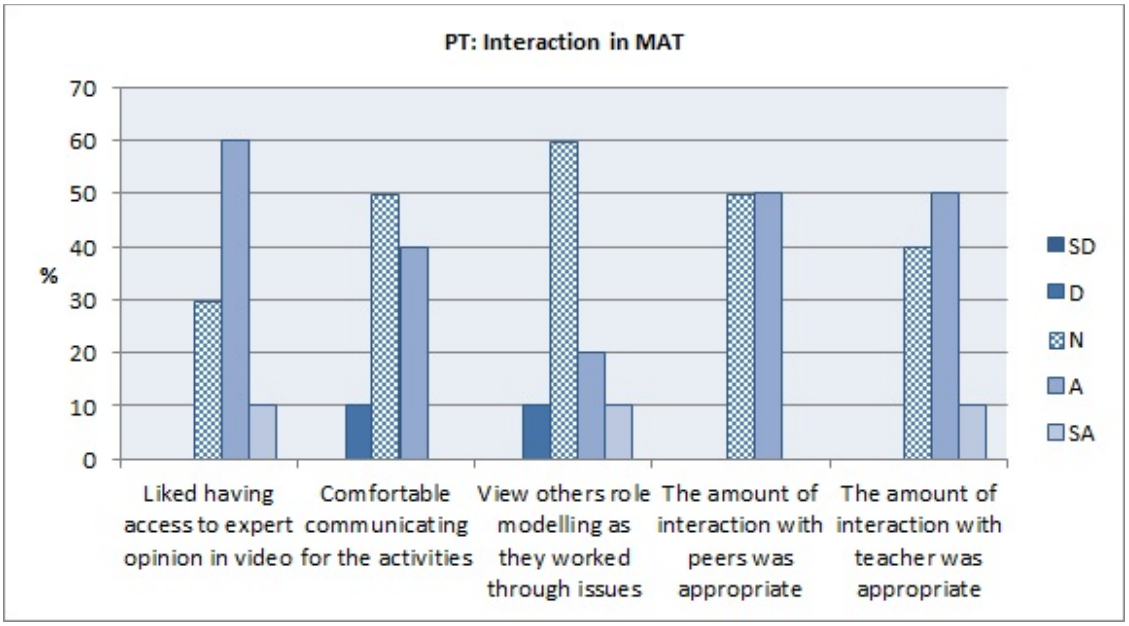


Figure 12. PT post-survey: MAT interactions

Example PT student responses in the post-survey to what MAT activities were helpful to learning included:

> Hearing the content of the interviews
> Case studies
> Interactive visual experience

PO model

The PO program, Certificate IV in Property Services - Owners Corporation, was tailored to meet the needs of those currently employed within owners corporation businesses. These students had some experience with workplace meetings; MAT activities facilitated the application of theory to the practice of conducting business meetings and elicited discussion of leadership and people management issues.

Prepare

To create conditions for the overall objective, to facilitate meetings in the property industry, initial theory classes were prepared, and a realistic but not overly prescriptive owners corporation meeting scenario. Other planning involved arranging breakout meeting rooms, time for group negotiation on role play approach, and technical support to video each of the role-played meetings in one take, as well as arranging MAT training and participation classes. Conditions set in MAT included:

- video preparation: four team videos of student role-played owners corporation meetings uploaded
- access for each group to one video (not own team's role play)
- creation of analysis categories (4) aligned to the curriculum: leadership characteristics, resolution techniques, notes for minutes, and minutes.

Participate

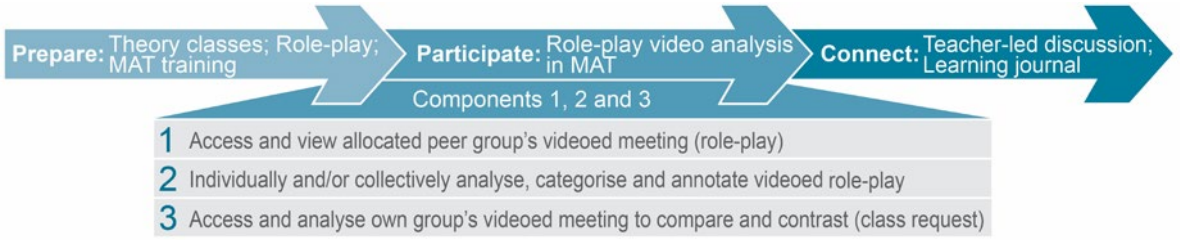


Figure 13. PO practice model

Figure 13 presents an overview of student participation components. Following recording of the role plays and video uploads to MAT, step-by-step activity instructions were provided comprising:

- Phase 1: Broad segmentation and labelling of skills in video
- Phase 2: Create minutes of meeting.

Student groups analysed their allocated owners corporation meeting, using the analysis categories. They identified positive examples of leadership characteristics and resolution techniques, guided by a list of generic examples within each as provided in their instructions. For each identified, the students annotated how this skill was demonstrated. They then worked in pairs (within their groups) to create minutes for the recorded meeting, using the options of either entering meeting notes piecemeal across the video using multiple notes for minutes (yellow) category or handwriting minutes as they viewed the meeting before submitting complete within one minutes (green) category. Some students adapted their own hybrid methods. To reflect industry standards, primary annotators had to endorse their own minutes and ask their peer to check for accuracy and co-endorse.

One student noted the benefit of watching another group other than her own to observe objectively; describing her process of participation as "actively listening" and providing "a lot of feedback" (PO student IPI, Jillian). Another student noted the disadvantage of reviewing a group that conducted an uneventful role play, where there were less obvious skills displayed. His work-around involved:

> So for lack of anywhere else to put a negotiation tag, I've put it … [where the meeting manager was] allowing them to make that discussion … [therefore] on behalf of the manager it is a technique that removes the requirement for arguments and negotiation later on, because they've had their say. (PO student IPI, Stavros)

By activity end, students had each created on average seven discrete annotations (range: 3–20 excluding threaded/reply comments) with 149 created by 21 active students.

The PO annotations tended to display two different styles. Figure 14 shows a descriptive reflection, justifying determination of skill with a range of factors from the segment of video (although some Phase 1 annotations were only descriptive notes). Phase 2 activities tended to elicit succinct functional notes (appropriate to the task of minute taking).

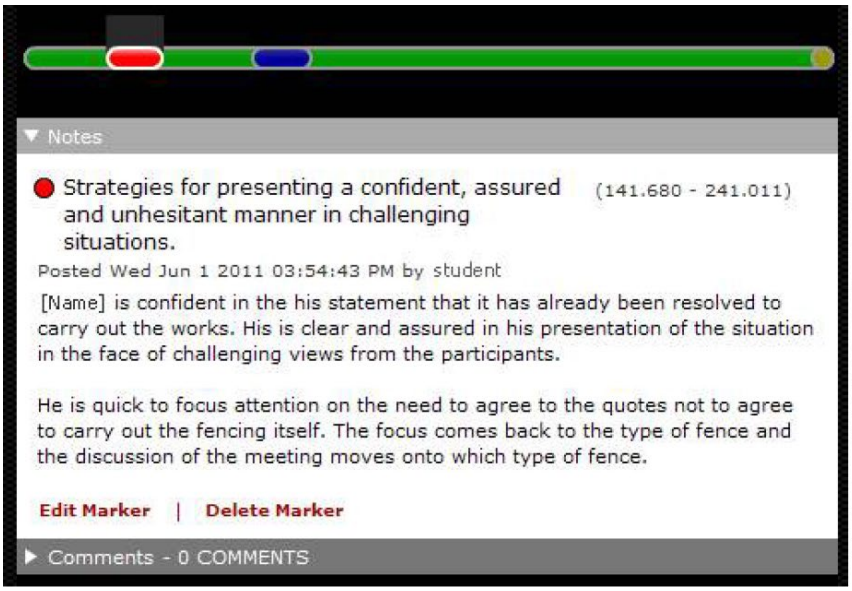


Figure 14. PO student annotation example (de-identified)

Connect

The connections within the PO subject, before ultimate workplace implementation, involved students comparing and contrasting their skill analysis with other students within their group, followed by in-class debrief. The students then requested wider access in MAT to enable comparison with other groups' analysis, including viewing their own role play and its peer analysis, which the teacher supported with additional debriefing. The final assessment involved documenting learning in individual journals guided by established criteria.

Survey responses to PO model

PO post-survey responses illustrate majority agreement (56%–89% agreed or strongly agreed) on questions related to MAT helping students to analyse and achieve knowledge aligned to intended outcomes (Figure 15) apart from understanding key concepts of leadership in meetings, which drew a largely neutral response (77%). Although leadership was evident in the role-played meetings (i.e., 89% agreed to analysis of leadership characteristics), key concepts may not have been adequately reinforced within the MAT environment.

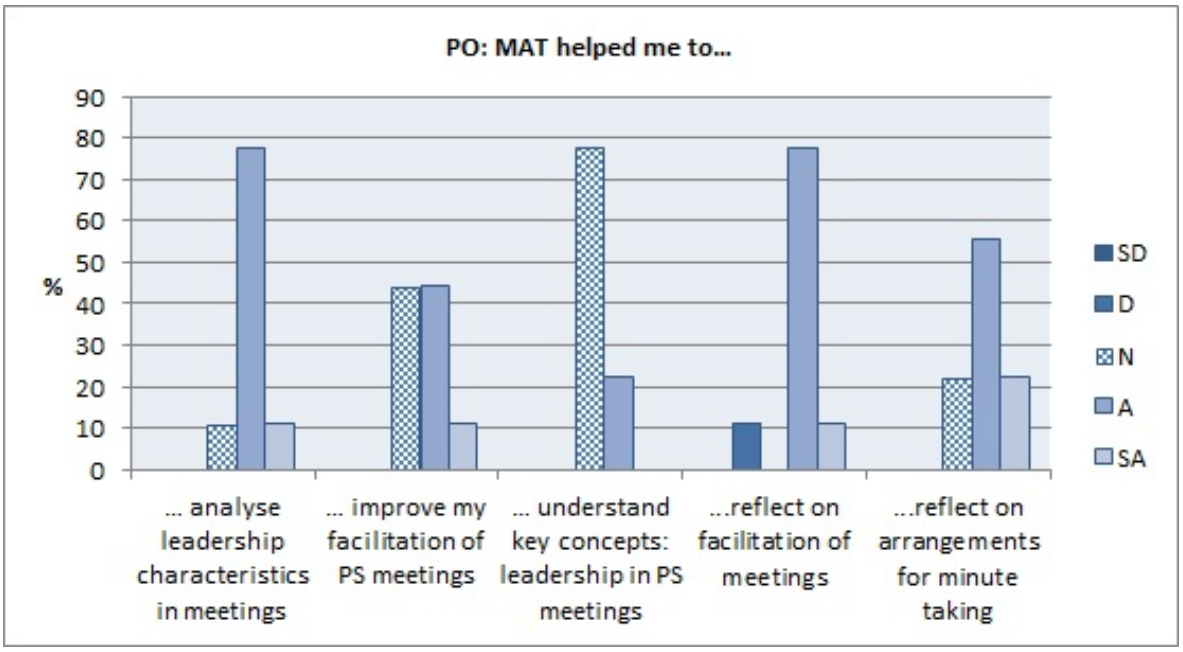


Figure 15. PO post-survey: MAT activities facilitating intended learning

PO students responded mainly positively to interactions in MAT (67%–89%) (Figure 16), tending to suggest the communication strategies suited this learning.

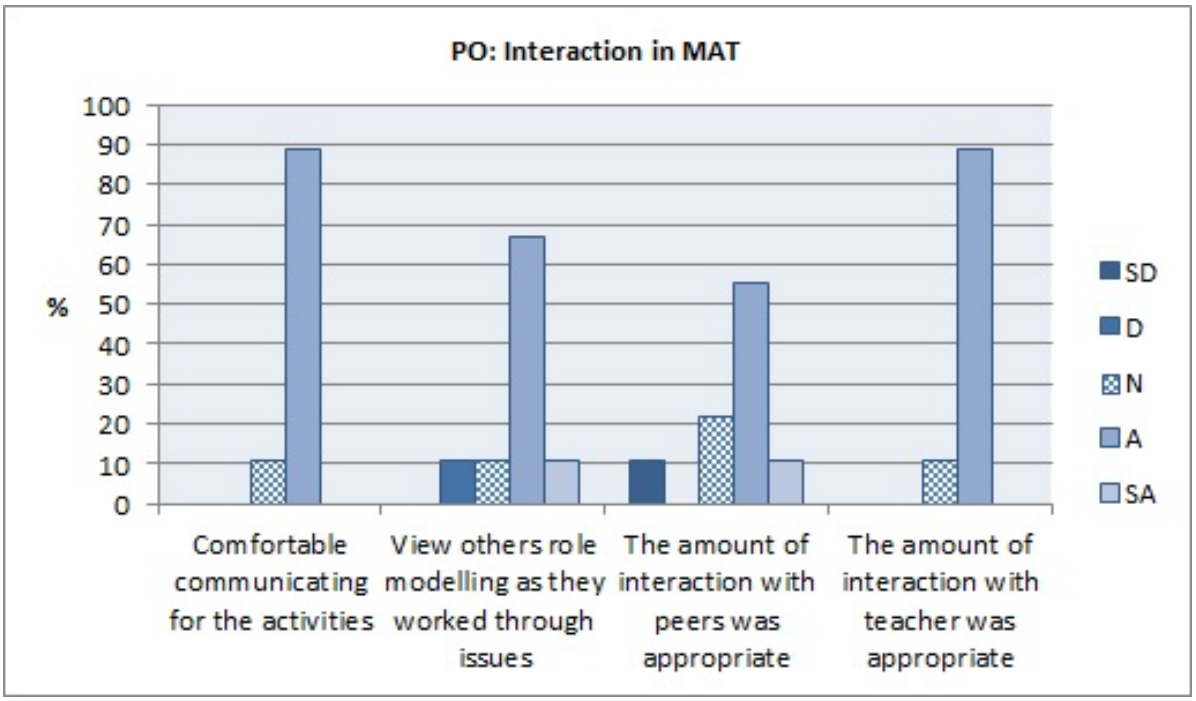


Figure 16. PO post-survey: MAT interactions

Example PO student freeform responses in the post-survey regarding MAT activities helpful to learning included “to go back over video to review”; “ability to analyse by different persons [sic.]”. However, one

student requested a repeat cycle of learning "to re-tape [role play] to review improvement after analysing your own".

Discussion

Analysis of the data from this study shows largely successful models of using video annotation framed in prepare-participate-connect processes. Some data indicates the need to review and improve practice. These indicators largely related to the prepare phase, including appropriateness of video, depth of learning expectations built into the instructions, timing of intervention, and whether teamwork was supported. Negative impact from such early decisions or actions ranged from reduced satisfaction through to a shallower level of learning. This discussion answers research question 3.

Dissatisfaction with videos manifested in some students in the AV cohort, compared to PD and PT students who also used case-based learning albeit with videos produced in-house. This reinforces the importance of suitable cases for case-based learning (Bennett et al., 2002). Additionally, Laurillard reports there is scarce advice on selection of resources in empirical studies "but clearly they have to fit the nature of the task" (2012, p. 127). The PD and PT case-videos were purpose-produced to the learning goals; the property services teacher designed his interview questions to meet curriculum requirements, ensuring his videoed interviewees discussed skills relevant to his students' learning needs. PD students, having access to one senior industry representative interview, responded with the greatest satisfaction for both analysing subject-related content and having access to expert opinion in video. This suggests that purpose-developed videos that include the authentic learning element of an experienced industry representative assisted student understanding better than third-party videos.

The PT students, who accessed videos produced in the same manner as PD but from various interviewees, also reported satisfaction in these areas, but had some disagreement on understanding networking issues in the videos. This could be due to the senior interviewee providing better coverage of this particular knowledge area for PD, or that PT at certificate IV level (compared to diploma) required further guidance. Importantly, in the data it was evident that the use of generic videos for AV seems to have undermined constructive alignment. The PO students, who generated their own role play videos, noted minority dissatisfaction with their videos. In the data, reference was made to whether some students were portraying a simplistic role play of leadership matters. The learning objective of the workplace skills would have benefited from students portraying a more dynamic role play including more substantial content elements.

While all student cohorts demonstrated active engagement with videos, the intended depth of learning may not always have been achieved. Students across the cases mainly created annotations of either descriptive notes or descriptive reflection while AV and PO students reported lower agreement with understanding of key concepts. Others using video annotation have recognised the need to better scaffold higher order learning (Pardo et al., 2015). Despite some uncertainty in the data about whether MAT aided PO students' understanding of key concepts, the PO student satisfaction in analysing and reflecting on subject-related content in the role plays was high. Hou (2012) indicated that some students who learn via online role plays "may jump to conclusions without going through a sufficient and complete cognitive process" (p. 220) recommending teacher attention and intervention. However, such intervention should be balanced to allow for student determination of key messages and for teachers to accept "any well substantiated interpretations (rather than conveying … [that their own] interpretation is the only correct view)" (Scheibe & Rogow, 2008, p. 15). Targeted monitoring of the role plays during development, or more probing role play instructions, may discourage the development of simplistic video without significant leadership concepts on display.

Only the AV students analysed their videos individually compared to a team approach, with resultant data illustrating reduced AV student satisfaction for interactions with others within MAT. Interestingly, on average the AV students created approximately twice as many discrete annotations per student compared to the other cohorts, albeit they didn't employ the team sharing and delegation roles by comparison, or any student-authored threaded conversation building on the video case analysis. The AV teacher employed video analysis to ascertain individual students' baseline knowledge before connections to skill development and demonstration via

collaborative role play. However, the individual nature of the task appeared to be less successful than the other cohorts' group use of MAT. Thus, enhancing the model with peer collaboration, along with deeper analysis, could further improve this initiative. Another issue affecting teamwork was timing in the PD case. This cohort's reported low satisfaction with interaction with their peers suggests that introducing the initiative too late in the course inhibited optimal participation and connection. In comparison, the PT and PO models' additional feedback and debriefing loops effectively formed iterative cycles and reinforcing practice.

An improved framework for teaching with video annotation

This paper presented four practice models of video-based learning in four vocational courses, employing either case-based or role-played video content that students analysed and categorised to respective employment preparation skills using an online annotation tool (MAT). These practice models were each framed in a prepare-participate-connect learning process (Greenberg & Zanetis, 2012; Rogow, 1997). While there are limitations in the sharing of practice models for uptake and adaptation by others, for example, to meet expectations of contextual and sequencing detail sufficient for teacher orchestration, they can provide inspiration for teachers to adopt and change practice (Falconer & Littlejohn, 2009). This study proposes the application of the prepare-participate-connect process to a new context. The changes are proposed to:

- enhance applicability to the tertiary sector (e.g., through connections to professional relevance)
- take advantage of affordances of digital video with annotation (e.g., categorising, self-authoring, team annotating).
- incorporate the practice models tested in this study (e.g., teaching strategies).

The process now offers a range of activities adapted for the tertiary sector and for affordances of digital video with annotation, providing a starting point for teachers contemplating the use of video annotation (see Table 4).

Table 4
Three-step process to promote interactive video-based learning for the tertiary sector (adapted and extended from Rogow, 1997; Greenberg & Zanetis, 2012)

Steps	Activities to support the steps
Prepare	Design and plan learning ahead of time. Determine appropriate video (or segments of), considering capability to generate and availability of third-party videos: • Clearly identify purpose of chosen video. • Identify intended learning outcomes and ensure constructive alignment between video, activities and assessment. Design learning activities and set conditions to support the rationale, such as: • mode of delivery: online/in-class/blended • teamwork/individual • pedagogical/teaching strategy (case-based learning; role play; other) • depth of analysis required • analysis categories • timing of intervention • specific participate and connect activities • clear and purposeful expectations communicated. Practise with and prepare associated equipment. Provide technological familiarity time/exercises to ensure reasonable student comfort levels to participate.
Participate	Preface video viewing with learning objectives, key questions, theoretical discussions, or other purposeful activities. Purposeful student use of video interactive affordances: • Enable flexibility of student-activated repeat viewing.

	• Allow for student control, e.g., pausing at important concepts to allow for interaction. • Enable captioning, categorising, self-authoring and team annotating and/or other interactive affordances to meet purpose, reinforce information, and evidence analysis. Work collaboratively: • Structure small groups for video content–focused conversation. • Allow students' own voice and to describe and share ideas/analysis within group. • Enable cross-comparisons of other teams' analysis to extend learning opportunity. Monitor: • Check in on student participation to ensure working/conversing to purpose. • Provide formative feedback as required, especially to promote required depth of learning.
Connect	Draw out connections of learning to other topics, activities, and/or professional relevance, via methods such as application, role play, debrief, discussion, reflective journal, feedback. Link forward or provide opportunities to translate to other learning and vocational/ professional experiences. Design connections and feed forward both within the participation activities, as well as after.

Conclusion

The findings of the study show that students engaged in the activities of video analysis were generally satisfied with their experiences of using video annotation. Factors including video suitability, individual versus team analysis, deep or surface level activities, and timing of intervention affected satisfaction and outcomes.

The authors consider the findings from this study build on Rogow's (1997) process for interactive learning with video. Through analysis of the data the authors have further developed Rogow's process to meet the needs of tertiary educators, retaining the three core steps for active viewing (preparation, participation, and connection). Supporting activities were adapted and expanded for the tertiary education setting demonstrating how educators can prepare and maximise learning opportunities for students studying online with digital video, including video annotation. This discussion of innovative practice models is framed in an easy-to-recall, principle-based process offering encouragement for the wider adoption of purposeful, active, video-based learning.

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