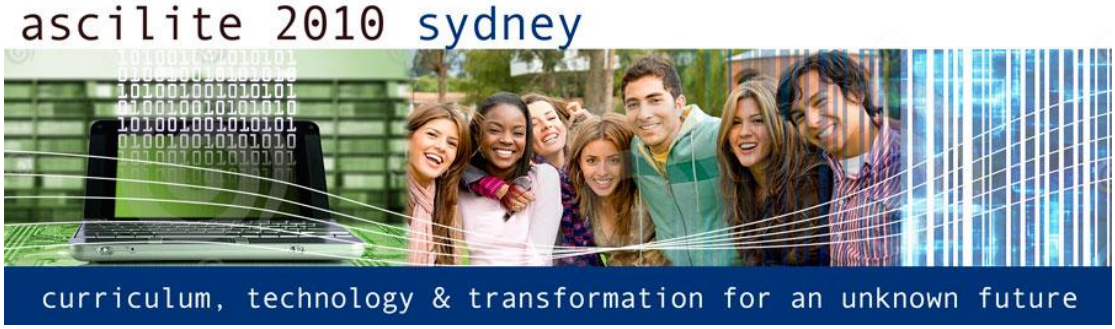

Future-focused learning via online anchored discussion, connecting learners with digital artefacts, other learners, and teachers

Meg Colasante
Academic Development Group, College of Science, Engineering and Health
RMIT University

This paper discusses a learning issue of diverging online communications when more convergent, targeted, artefact-specific discussions are required. It contributes to whether anchoring annotations to specific components of digital artefacts helps build conversations useful to learning. While aligning interaction to artefact has been previously noted for its benefits, here it presents in the context of a tool to help achieve this – a new media annotation tool, '*MAT*'. Learner analysis, peer discussion and teacher feedback are promoted within this tool, together anchored to an artefact of learning focus in carefully designed cycles of learning. The paper discusses various educational design features of *MAT* that enable learning by online artefact-centred discussion, including learner use of these features. It draws from a recent case study on video annotation for critical reflection and evaluation of physical education teaching practice. *MAT* has been evaluated in this context, but requires wider integration and evaluation to determine usefulness for promotion in a range of other academic practices.

Keywords: artefact-centred learning; media annotation; online anchored discussion

A new artefact-centred annotation tool

The literary framework for the educational design of RMIT University's new media annotation tool, '*MAT*, included broad learning theory: constructivism/socio-constructivism; and literature related to major learning elements of the tool: artefact-centred learning, reflection/analysis, online annotation/interaction. This paper focuses on the design features enabling converging artefact-centred interaction, and the first user cohort uses and opinions of these features.

The paper draws on research that examined the integration of *MAT* into a higher education context, for physical education (PE) student analysis of their videoed teaching practice. Employing case study methodology, it aimed to explore and reveal details about how this online environment might be used by learners and teachers to support learning. This paper homes in on findings from research questions on how students used *MAT* to interact meaningfully with an artefact, their decision and deliberation factors, and their identification and use of significant learning features to achieve 'artefact-centred discourse' (Suthers & Xu, 2001).

There are several media forms suitable to represent artefacts online for learning purposes, video is one of them and was the medium used in the study. However, video on its own can be a passive learning medium; learners need to actively think about and process information in the recording to "sufficiently engage learners in active, constructive, intentional, authentic, and cooperative learning" (Jonassen, Howland, Moore, & Marra, 2003:124). Learners also need to have sufficient time to appreciate and describe what they experience via video, and further guidance to modify their analysis if required

(Laurillard, 2002). Jayawardana et al (2001) offer that "Video sources are more effective as learning resources when segmented and integrated with annotations from other media types" (p.2).

Figure 1 provides a screen capture of a *MAT* test site, where a timeline aligned to an artefact was marked-up at various points of analysis with a range of coloured and categorised 'Markers'. It presents as reviewing the only pink 'Teacher Position' marker, tag-named 'Sun/shadow', and is anchored to a section of video approximately 22 minutes into a recorded lecture presentation (that is, a 'Lectopia' recording). There is text annotation entered in the 'Notes' panel. The rest of the annotation area anchored to this point can be opened and read by clicking on the various panels, of 'Comments', 'Conclusion', 'Lecturer (teacher) Feedback', or 'Final Reflections'.

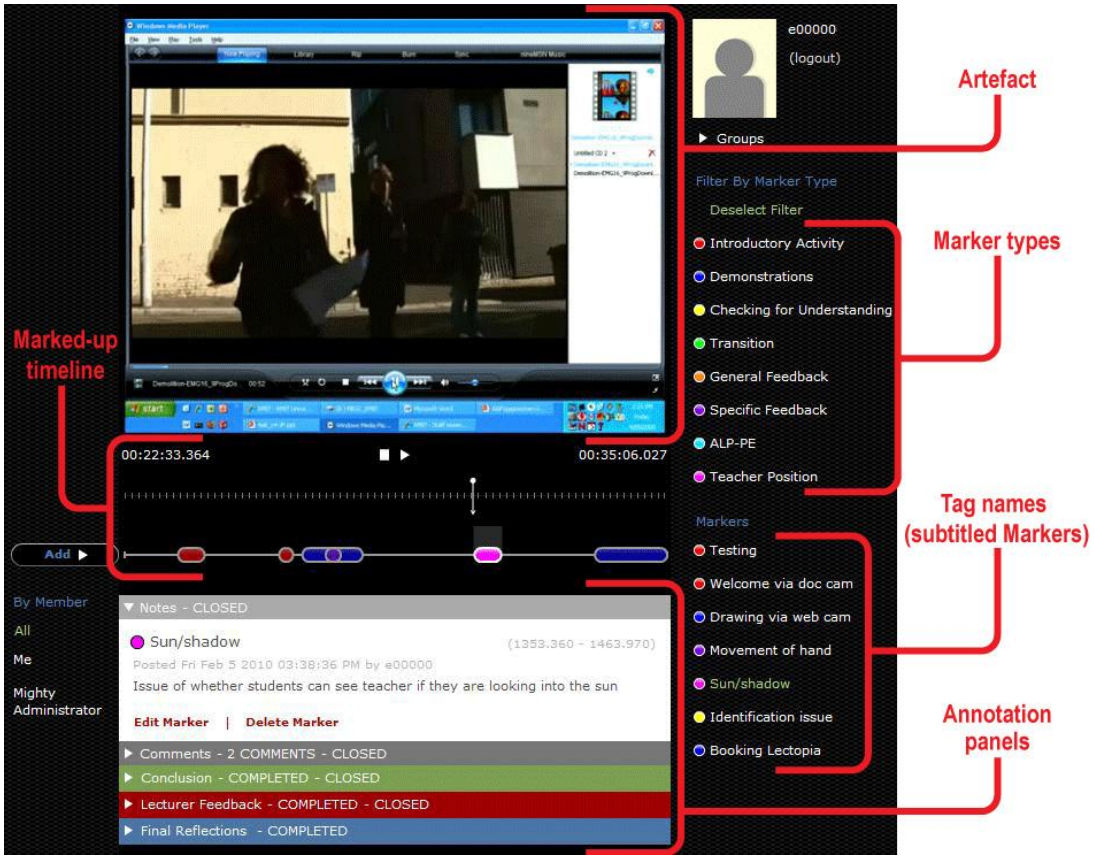

Figure 1: *MAT* test site (recorded lecture presentation: reading Notes in 'pink' Marker)

Artefact-centred learning

Online artefact-centred learning environments tend to evolve from a need to better access or represent the focus (or foci) of learning in a digital format. The digital form could present as video, audio, image, text, or in media combinations (e.g. lecture screen capture with audio, as in figure 1). A prime reason for artefact-centred learning is to enable learner interaction to build meaning from the artefact.

Examples of electronic artefact-centred learning can be found across tertiary education. One undergraduate study used multimedia representations of chemical reactions that "occur at rates that are so fast or slow, or their products are so dispersed, colorless, or odorless, as to make them difficult to detect" (Kozma & Russell, 1997:949). The study recommended engagement with such media for the construction and reflection of meaning via description, explanation, questioning, and discussion. A post-graduate example presents a digital solution for distance learner access to quality, authentic, veterinary radiographic and ultrasonic images compared to limited conventional mailing of these delicate artefacts (Phillips, Pospisil, & Richardson, 2001). A subsequent gap was noted in this learning to provide "more opportunities for communication and discussion of diagnosis … [and improve] feedback to students" (Phillips et al., 2001:219). Many online learning environments do not allow for adequate discourse in the direct context of an artefact (Suthers & Xu, 2001).

There is dissatisfaction evident with the divergent nature of communications in commonly available online collaboration tools, particularly when keeping dialogue converging on, or anchored to, an artefact is required. Lapique and Regev (1998) found "news groups lack the contextual binding that exists between a [digital] document and its annotations … [and discussion] threads tend to diverge after a few iterations making them incomprehensible for the newcomer" (p.2). van der Pol et al (in press) found computer-mediated communication constrained for keeping discussion relevant, and defer to 'online anchored discussion' to "integrate… students' online discussion with the subject matter that is being discussed" (p.1). Jung et al (2006) add that typical collaboration on the web via discussion threads, blogs, or wiki can suffice until there is a need to focus on a part and not the whole of an artefact. Suthers et al (in press) promote the concepts of coherence and convergence, which they say can be lacking in threaded discussions and chat rooms. They, like Jung (2006) & van der Pol et al. (in press), recommend that artefact-centred discourse needs to have clear linkage between learner contributions and specific components of the artefact, plus clear points of "summary of the status of the collaboration, available to learners and mentors to support reflection and assessment" (Suthers 2001, in Suthers et al., in press:3).

Aligning collaboration to context has its learning benefits. Jonassen et al (2003) (who also support the need for discussion to be clearly and finely linked to a focal artefact) say that "the goal should be to have representation along with explanation[;] … [whether] it is physical or conceptual, being able to represent the knowledge and explain the behavior is a powerful learning tool" (p.190). Glover et al (2007) state that a "close tie to the underlying context allows the annotations to contain the minimum amount of information required for understanding, which in turn allows the reader to interpret the information at a glance" (2007:1309). Kienle (2006) elaborates with two advantages. First, minimising discourse to that required to complete the concept/idea/communication, that is, not having to relay what is already explicitly represented (which helps solve one problem of having to over-explain things in a fully distance/online mode). Secondly, providing further clarity to words, that text alone may not offer (for example, ambiguous meanings in language).

Annotation in a new digital and collaborative context

Tools that enable learners to annotate digital resources can form the base environment for artefact-centred discussion. Annotation "can represent comments and remarks users create for themselves or for others, referring to a specific piece of content (word, paragraph, image region etc.) …[which] helps in subsequent review of the content" (Petkovic et al., 2005). When employed in collaborative activities, annotations "can serve to ask questions, clarify points, and enhance the understandability of information available in the repository" (Churchill et al 2000, in Petkovic et al., 2005).

With an enabling structure, annotations can build to discussions. Kienle (2006), for example, advises a framework or cycle of learning in collaborative actions. Feito and Donahue (2008) advocate learner self-talk to "speak back to theory" (p.297) plus recommend in-built system support, recognising that learners who have not yet built up their discourse to sufficiently categorise their learning (for example, the type that underlines key points in text rather than annotates), "may be that they have not yet considered how best to name their repertoires in order to make them operative; this, then, is something students must be taught" (Feito & Donahue, 2008:306). Krottmaier and Helic (2002) suggest clear annotation categorisations are useful flags for subsequent readers, albeit note that new technology is needed to help manage annotations.

Not all authors champion structure, noting "a caution …[that] users may resist categorisations, seeking more flexible or unanticipated ways of collaborating" (Dwyer & Suthers, 2006, in Colasante & Fenn, 2009:3548). Baker and Lund (1996) argue that rigid structuring of an electronic collaborative environment could force unnecessary interaction and interrupt a cohesive flow. However, their own 'flexibly structured' approach is still quite explicitly structured, and they concede structural form as long as it is "for constructing hierarchically interaction histories rather than for controlling the form of dialogue" (Baker & Lund, 1996:1, emphasis removed).

Methodology

A case study research methodology was employed, aiming to provide insight of learning experiences within a given context. The case under examination was a single cohort of undergraduate physical education (PE) students using *MAT* in their learning, plus their teacher/key academic.

The case study employed mixed-methods of data collection. This included pre- and post-test surveys and interactive process interviews (a combination of direct observation and interactive/semi-structured interviews), yielding both qualitative and quantitative data. Using mixed or multiple methods "is a major strength of case study data collection" (Yin, 2003:97), providing opportunities for depth in detail and for cross-validation of the research issue.

The participants of the research were undergraduate PE students enrolled in a third year practical experience subject, comprising 31 students, plus their class teacher. Twenty six students consented to participate, and 23 ultimately participated. Seven participants also volunteered for individual 'interactive process interviews' (IPIs) as did their class teacher.
The participants were involved in the following data collection procedures:

1. Completion of a two-part paper-based survey (students only, *n*=23):
   a. Pre-test administered within the first week of semester, to collect detail on previous experiences in reflecting on teaching practice, expectations of using *MAT*, and learner profiles.
   b. Post-test administered at the end of semester, to collect information about experiences of using *MAT*.
2. Individual, audio-recorded 'interactive process interviews' (IPIs), conducted in the second half of the semester, involved both direct observation and semi-structured interviews (student *n*=7, teacher *n*=1), to collect information about how *MAT* was used, and learner/teacher experiences of using *MAT*
   a. Observation phase: each participant used *MAT* and 'thought-aloud' as they did so.
   b. Semi-structured/interactive interview phase: open-ended questions encouraged each participant to discuss their experiences using *MAT*.

Ethics approval to conduct this research was granted prior to data collection. Pseudonyms have been used for participants.

Findings

The research findings comprise data from across the breadth of the class via the pre- and post-test surveys (*n*=23), and in depth via the interactive process interviews (IPIs: observations and interviews) (*n*=7; plus the class teacher). The survey results presented the learner cohort as a largely homogenous group of primarily typical post-secondary university age, with good education and IT skills, and all but one were born in Australia. The male-to-female ratio was fairly even at 10:13.

Under observation, the learners moved actively through *MAT*, in their own media and that of the peers in their group, looking for new content. They were all quick and confident in identifying and using significant learning features, only slowing down to read annotations, or to work-around technical issues. All accessed the Markers, Notes, Comments, and Conclusion panels, multiple times, confidently. (Note that some of the participants used the term 'tag' interchangeably with 'Markers'.) No student entered new data under observation due to the stage they had progressed to, that is, near finished analysing their first (pre-test) video and awaiting teacher feedback. The Lecturer Feedback annotation panel was frequently investigated by some, infrequently by others, despite yielding no entries at that stage. None investigated the 'Help' files under observation, but they may have at other points of the semester (see related survey results in Figure 3, where there was some reported access).

Almost two weeks after the student IPIs, the teacher, 'Carl', used the observation phase to productively work in *MAT*, reviewing student analysis of their second (post-test) videos. With limited time left in the semester, he shortened this second analytical cycle to Notes and Comments only. He actively reviewed Markers by watching segments of video and reading their anchored Notes and Comments, and entering his feedback into the Comments panel. Carl's preparation included preparing his students for reflective learning, aligning a written assessment task to draw from their work in *MAT*, and pre-determining the Marker types (categories). These Marker types included key teaching factors of: 'Introductory Activity' (red), 'Demonstrations' (deep blue), 'Checking for Understanding' (yellow), 'Transition' (green), 'General Feedback' (orange), 'Specific Feedback' (purple), 'ALT-PE' (academic learning time; light blue), 'Teacher Position' (pink).

A common method of learner use of *MAT* emerged from the observation and interview data, which is summarised in Table 1: the 'Activities observed' column, and supported by examples in the adjacent

column. The learners first accessed their own group in *MAT*, and then accessed their own video of recorded teaching practice to commence analysis (critical reflection and evaluation). They then tended to move through the analysis process as tabled (see Table 1).

Table 1: Features—and related activities and examples—presented in typical order of use

Feature	Activities observed	Examples of specific participant use
Markers ↓	While viewing their own video, the learners selected and marked sections: A Marker was added and dragged along the timeline for the length of the selected section, they then categorised the Marker using the pre-set teaching categories.	"[the Marker types] gives you the starting point like which ones can I use, what did I actually do in my lesson" (Donna). "[the Markers get] you to actually focus on specific things, rather than just looking at the lesson overall" (Desi). "I would choose one of the Markers I wanted to add, so … right now I could talk about 'Teacher Position', and I'm rocking back and forth and playing with the equipment" (Brittany).
Tag name ↓	They further titled the Marker by entering their own subtitle or tag name.	"for different Marker types … you can click on say 'Demonstrations' and you can see the different spots where you gave 'Demonstrations' throughout the lesson and by giving them a [tag] name it helps jog your memory to what activity you might have been trying to demonstrate it for" (Brett).
Notes ↓	The learners annotated their video with initial comments in the 'Notes' annotation panel anchored to each selected area of video. Typically they entered detail based on what was happening in that segment.	"I just tagged my own teaching and put comments about things that I thought were negative and/or positive" (Nicole). "'student demonstration'; my heading [tag name] was that so I knew that's what I did. I wrote a comment [Note] about why I used the student to do the demonstration and how that benefits my teaching and in the hope that someone else would comment back to me" (Renee).
Comments ↓↕	After one to three weeks, they returned to view a group member's video, read the annotations, and decide whether to give feedback to that peer in the 'Comments' annotation panels. They repeated this for others in their group.	"That's one of my Comments there that I've commented on … [peer's name] … basically what I've just said to him is whether, what he is saying or doing was appropriate for the time of the lesson or how I could assist, like helping him out with what he was doing, and I basically told him what he could do better, but I always gave him something positive that he did" (Renee). The quality of peer feedback was raised as an issue by a majority of interviewees, in that not all Comments from peers were helpful.
Conclusion ↓↕	Returning to their own video, the learners read Comments received from peers and further annotated some or all of their marked areas of video by writing summary or other annotation types in the 'Conclusion' panels.	"[I received] a Comment saying 'good teacher movement, you're moving to next activity, however, you've turned your back on your students, and someone … [another peer] said: 'yes, perhaps you could try ABC' then I wrote a Conclusion … 'OK, great, so next time I need to try to keep my back to the outside of the lesson, rather than walking through the middle'" (Brittany). "[on reading others Conclusions] everyone's taking on board other people's feedback and they're positive that they'll implement in future lessons" (April).
Lecturer (teacher) Feedback ↓↕	The learners sought feedback from their teacher via 'Lecturer Feedback' panels, plus reviewed complete video-anchored annotation cycles in both their own and their peers' videos. All sought Lecturer Feedback entries but did not find any at that stage.	"[when the teacher gives] a couple of comments on the big issue[s], the big things that you had in there, it'd be really good because they've obviously taught a fair bit and it's good to hear comments from an experienced person rather than a person that's at your own level and you're sort of both learning together and you need to think you could both be going off on the wrong tangent. The teacher could at least bring you back and go 'you need to be pointing in this direction'" (Brett) The teacher ultimately provided feedback in Comments panels, due to technical delays.
Final Reflections (↕)	The learners did not enter 'Final Reflections', as this area was not yet available to them. They were shown this feature during interviews to harness first impressions.	Five out of seven interviewees said their use would 'depend', e.g.: on how important the issue was under analysis, or whether they received feedback from the teacher, and then if they wanted to respond to that feedback. "if … [the teacher is] giving more constructive feedback other than what the people in my group did then, yeah, I think it would be a good thing to respond to, but it depends on what they are actually saying" (Desi)

All students interviewed agreed that *MAT* helped them to reflect on and evaluate their teaching practice, particularly for the ability to see their teaching performance via video, and receive feedback. The ability to anchor discussions directly to the focal points of the video was commented on via the Markers, which provided this key anchorage. Examples include:

> The Markers were really good … you click [on them] and it would take you to that part of the video and you can read what you have written and what other people had written about what you'd said (Brett).

> … when I click on Markers I could see where all my Markers were and it was easy for me to just go back through and see well OK I'll go back and look at my 'Questioning' one and I'll write about that and it was easy to come up and have a look at what I wrote for 'Questioning' … [and later adding] … we've had to do a similar assignment, but we didn't have *MAT*, and it was hard to look at your teaching through a video without having any Markers or anything and saying OK I'm looking for this; I'm looking for that, where-as now I've got direction for what we are looking for (Renee).

Despite the appreciation of the Markers, there was a challenge noted. One student surveyed and two interviewed referred to the Markers as too big, noting not being able to make the Markers small enough to align directly with teaching issues under analysis. For example:

> … some of the tags [Markers] can be too long, you can't make them much smaller; there's a certain size it only goes to. … during the video some people can see where …[the action referred to is] but they might have to go back and forth, like if I've put a tag or when I've given feedback mine might only last for about five seconds where-as the tag on the actual screen shows it up …[for around] 30 seconds (Donna).

The teacher/key academic nominated the Markers as the most helpful feature in *MAT*, which aided his monitoring of student work by "not having to look at the whole video but I could pick out parts that I really want them to focus on … [and] have a look at that" (Carl).

The post-test findings for features of *MAT* accessed and/or used (*n*=23), have been split for ease of viewing. Figure 2 illustrates the annotation panels of the learning cycles, both in the respondents' own teaching analysis ('mine', 'me'), and in their peers' ('others'). Figure 3 then illustrates other functional and support features that students had access to.

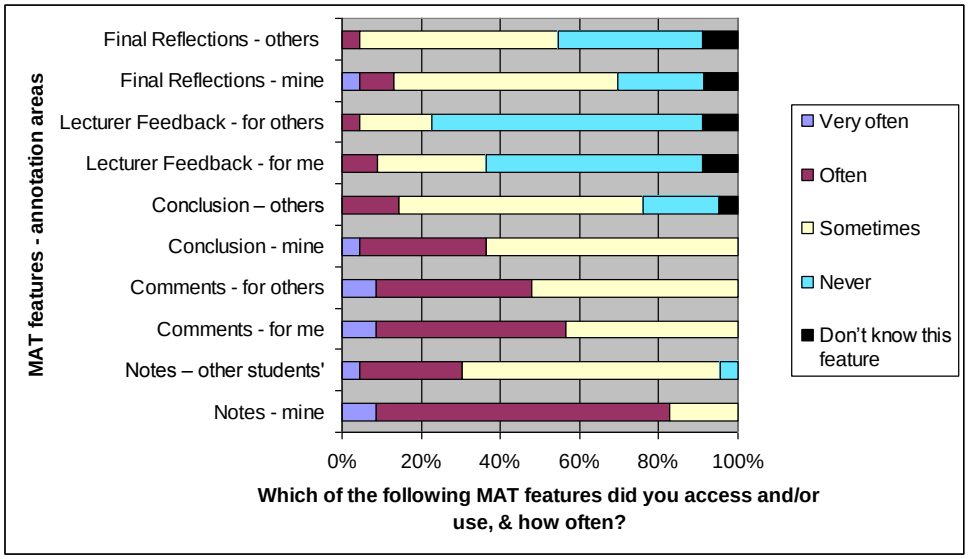

Figure 2: Survey of *MAT* features used/accessed: (a) annotation areas

Figure 2 tends to support the trend observed, of more learner activity in Notes, Comments and Conclusion, than for Lecturer Feedback and Final Reflections. The learners reported more activity in own analysis activities than for others. It is also notable that two learners surveyed reported not

knowing about the latter two *MAT* features and others never accessed them, while one learner did not access any of their peers' Notes, and five never accessed Conclusions of their peers.

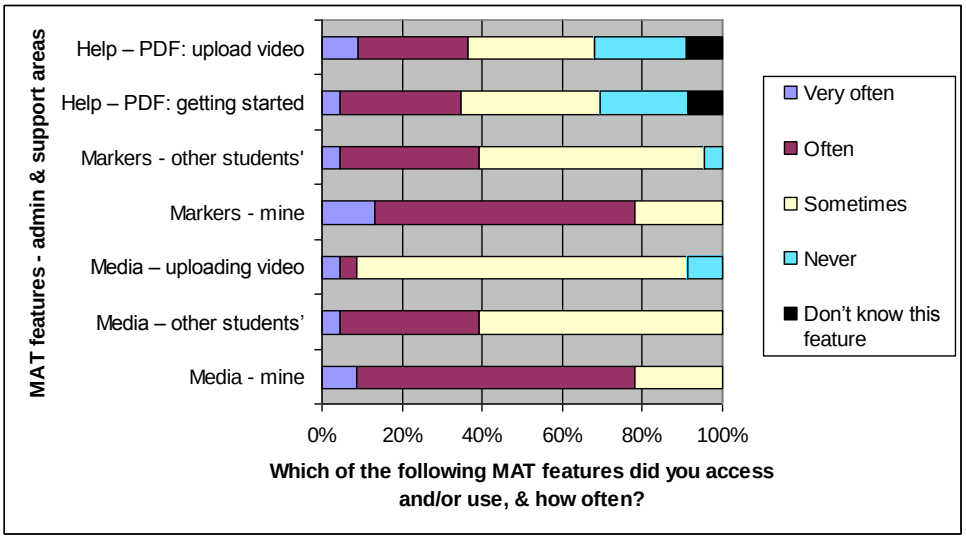

Figure 3: Survey of *MAT* features used/accessed: (b) admin/support

Figure 3 shows regular access/use patterns for media (video) and Markers; noting more attention to own media and Markers than for peers. The low levels of media uploading correlates to only two videos collected over the semester, and the single 'very often' response came with the comment: "tried uploading", implying multiple attempts. Around one-quarter of the respondents did not access the help files, and two of these did not know they existed. However, given only two reported never uploaded media, it is plausible the remainder did not need the help files for uploading videos.

Factors of influence

The learners under observation (thinking-aloud) and interviewed provided detail about what influenced their decisions and deliberations in *MAT* while evaluating their teaching practice. There tended to be two prominent categories of factors of influence; that of 'process' (learning/assessment requirements or technological framework) (see Table 2), and 'input' (text/annotation entries) (see Table 3).

Table 2: Decision and deliberation factors – Related to 'process'

		Factors of influence	Examples from IPIs
PROCESS	Learning & assessment req	Learner decisions tended to follow learning and assessment directives (given or perceived).	"our [initial] task was to go in and look at our own video and mark the different Markers in there" (Desi). "we had to go to everyone's video, and comment on at least three or four of the tags [Markers]. So for each student, each member of my group, I'd have to do three or four comments on any three or four of their tags. And then later once we've done that, that's when we went back and have a look at all the comments the other people have left for ours, our video" (Donna).
		The related assignment affected learning processes, where learners chose an area of focus in *MAT* to draw out into their assignment	"we didn't have to put a Conclusion on all of our tags. Although originally I think we were supposed to, but because of the time delay of this occurring we didn't have to. So I put in a Conclusion in regards to what [teaching factor] I'd chosen to work on for my assignment in regards to that area that I'd tagged" (Nicole)

	Tech framework	The technical ability to close *MAT* annotation panels: (a) curtailed some flexibility by the learners under observation, e.g.: inability to add a new Marker (b) however, it did provide some streamlining of process	(a) "just dragging my Marker to an empty spot; just see if I can add a new one. Oh that's closed off so I can't add any more" (Brett) (b) "we had a format to follow where we had to Mark our own work first and then comment on our own [enter Notes] then Comment on other peoples', and then reply to their Comments, so … we had to follow in that order, because … the Comments section would be closed off after a certain time so we had to make sure we commented before whenever that time was" (Desi).

Table 3: Decision and deliberation factors – Related to 'input'

	Factors of influence	Examples from IPIs
INPUT	All students observed were active in seeking new input from their peers and teacher.	Some students were observed checking all their Markers for new entries, e.g.: "Just clicking on all the tags to see I haven't missed a comment from a group member on my teaching" (April).
	Finding no or minimal new input tended to affect student decisions, primarily to move on.	"[I will] click on 'Checking for Understanding', there's one Comment made but no Conclusions. Click on another member …" (Brett). "Then there's no feedback from the lecturer yet, so I'll try another tag" (April).
	There were decisions made about whether to make new entries upon reading others' entries.	"when you were reflecting on someone else, if you click on the different Markers they had and read them, watch that part of the video, and you can choose whether or not you wanted to comment on it, whether it was important" (Brett). "I clicked on her tag for 'Feedback on passing' and I'd just written in 'This is really good how you gave specific feedback on passing' and pressed 'save', and so that would come up on her video. When she clicked on her - that same tag on her video, so she could see that, and then she could write the Conclusion" (Donna)
	Upon finding new entries in a peer's work, they tended to read them and sometimes were inspired to take action, or at least stay to investigate.	"OK there's two Comments from other group members on … [peer's name] so I'm just reading about that; it also gives me an idea of what I could do with my own teaching, reading other people's comments" [proceeds to own media to compare to own analysis] (April). "So this one's really good. He's done quite a lot of Conclusions so that gives everybody something to read" (Brett).

MAT was largely perceived as a suitable environment for communication and collaboration. Only one survey respondent disagreed that *MAT* was an excellent tool for collaboration with others (fig.5).

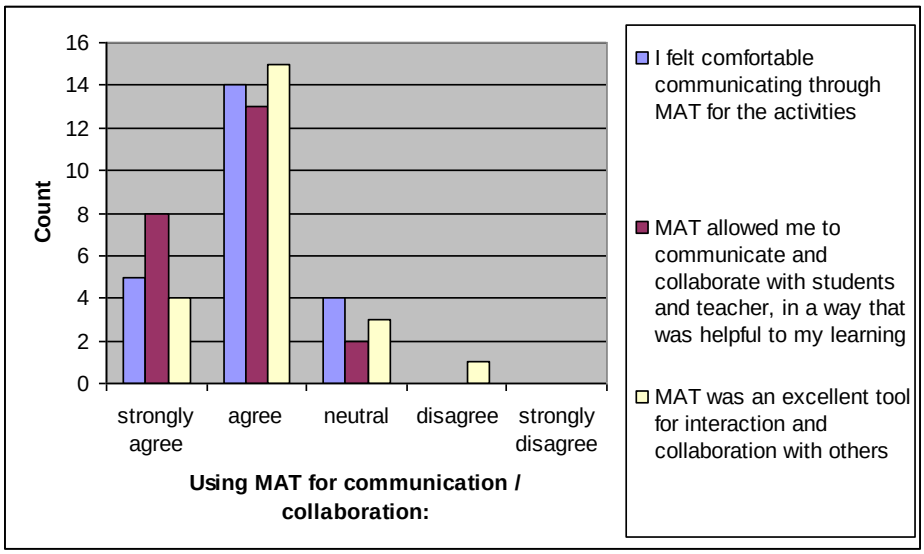

Figure 5: Effectiveness for communication/collaboration

Discussion and conclusion

The learners analysed their videos of teaching practice by using Markers to categorise sections of the video, and anchor annotations to. There was much use and appreciation of the Markers, including the categorisations of the Markers by the teacher to match the pre-determined teaching criteria. However, the Markers need to be investigated to see if they can be created smaller than their current ability, to link annotations to more finitely accurate points of artefact. The ability to subtitle or tag name each of the Markers seemed to work well in *MAT*, with the learners confidently accessing and discussing this feature under observation. To help keep annotations rich, Marshall (1997) recommends allowing for learner's own inventive coding systems; the ability to further title the Markers helps towards this. The learners noted the usefulness of the Markers as anchorage between video segments and annotations. This seems consistent with Kienle's (2006) finding on technically supported communication processes that "Authors of the annotation are able to make explicit the connection between content and annotation and recipients are able to perceive both together" (p.169). They also confidently accessed and/or used most of the other features of *MAT* available to them, including video, and the annotation panels of Notes (by learner), Comments (from peers, and occasionally teacher), Conclusion (by learner) and Lecturer Feedback (from teacher), although the last was limited by functional delays. They anticipated a Final Reflections annotation panel may be helpful in the future, depending on the circumstances. Further evaluation of these features is recommended.

MAT was positively endorsed by the learners as a good tool for communication, and helpful to learning. This suggests the framework for collaborative annotations in *MAT* provided opportunity for socio-constructivist learning, but this requires further confirmation. One study found two groups of students comparative for loosely-structured versus semi-structured email discussion, where the latter achieved more with the aid of additional supports, explicit prompts, and questions, concluding that online discussions benefit from a carefully considered framework (Whipp, 2003). The learners observed and interviewed tended to be influenced in using *MAT* by two prominent factors, that of following a process to meet the learning and assessment requirements and within the technical framework of *MAT*, and responding to the input of others. Both of these factors seemed to stimulate action, but a question could be raised on whether the removal of one factor might affect outcomes.

Future academic uses of *MAT*

Other artefacts useful for learner analysis in *MAT* could include other learner-generated media, in video (or image, audio, or digital text once *MAT* is expanded). It would be opportune to compare this study's use of videos to other learner-built artefacts in other disciplines, such as case studies acted out by learners and captured in digital media. Alternatively, already produced third party resources could be analysed, such as artefacts not readily accessible, historical items, international expert opinions, or phenomena for extended examination. The potential is endless, pending correct permissions gained. Jayawardana et al (2001) noted that personalised views could be built on audio-visual digital materials once tools were provided that "facilitate active consuming while safeguarding copyrighted material".

The use of *MAT* in the context of PE teaching practice encourages trialling in professional practices of other disciplines. With the business community already "[video] capturing and annotating important business events, such as meetings and seminars, for ease of later review and improving business performance" (Butler, Zapart, & Li, 2006:20), analysing workplace or simulated practice is not alien. Industry experts could contribute to the learning processes in *MAT*. They might provide feedback in one of the annotation areas, recognising that "As learners work through content, they will find the need for … support, which could take the form of learner-to-learner, learner-to-instructor, instructor-to-learner, and learner-to-expert interactions (Moore, 1989, Rourke et al., 2001, Thiessen, 2001, in Ally, 2004:22). Industry might supply 'real-life' or professional artefacts for analysis, for example, videoed procedures, images from workplace sites, other. Or perhaps participate in a 'worked example' or an 'expert solution' in *MAT*. That is, an expert might annotate a case in a critically reflective or problem-solving manner, as a resource for learners to compare with their own analysis in a similar or contrasting case. By "using experts' annotations as models… students can observe the process of reflection and then compare and contrast their own reasoning and reflection … to that of the experts" (Lin, et al, 1999:51). Relevance is anticipated beyond undergraduate to the vocational and postgraduate sectors.

References

Ally, M. (2004). Foundations of educational theory for online learning. In T. Anderson & F. Elloumi (Eds.), *Theory and practice of online learning* (pp. 3-31). Canada: Athabasca University.

Baker, M., & Lund, K. (1996). *Flexibly structuring the interaction in a CSCL environment.* Paper presented at the EuroAIED Conference, Lisbon.

Butler, M., Zapart, T., & Li, R. (2006, June 25-28). *Video Annotation – Improving Assessment of Transient Educational Events.* Paper presented at the 2006 Informing Science and IT Education Joint Conference, Salford, UK. https://doi.org/10.28945/3019

Colasante, M., & Fenn, J. (2009, June 22-26). *'mat': A New Media Annotation Tool with an Interactive Learning Cycle for Application in Tertiary Education.* Paper presented at the World Conference on Educational Multimedia, Hypermedia and Telecommunications (ED-MEDIA) 2009, Honolulu.

Feito, J., & Donahue, P. (2008). Minding the gap: Annotation as preparation for discussion. *Arts and Humanities in Higher Education, 7*(3), 295-307. https://doi.org/10.1177/1474022208094413

Glover, I., Xu, Z., & Hardaker, G. (2007). Online annotation – Research and practices. *Computers & Education, 49*, 1308-1320. https://doi.org/10.1016/j.compedu.2006.02.006

Jayawardana, C., Hewagamage, K., & Hirakawa, M. (2001). Personalization tools for active learning in digital libraries. *The Journal of Academic Media Librarianship, 8*(1).

Jonassen, D., Howland, J., Moore, J., & Marra, R. (2003). *Learning to solve problems with technology; A constructivist perspective* (2nd ed.). Upper Saddle River, New Jersey: Pearson Education, Inc.

Jung, B., Yoon, I., Lim, H., Ramirez-Weber, F., & Petkovic, D. (2006). *Annotizer: User-friendly WWW annotation system for collaboration in research and education environments.* Paper presented at the Web Technologies, Applications, and Services.

Kienle, A. (2006). Integration of knowledge management and collaborative learning by technical supported communication processes. *Education and Information Technologies, 11*(2), 161-185.

Kozma, R., & Russell, J. (1997). Multimedia and Understanding: Expert and Novice Responses to Different Representations of Chemical Phenomena. *Journal of Research in Science Teaching, 34*(9), 949-968.

Krottmaier, H., & Helic, D. (2002). *More than passive reading: Interactive features in digital libraries.* Paper presented at the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2002, Chesapeake, VA.

Lapique, F., & Regev, G. (1998). *An experiment using document annotations in education*. Paper presented at the WebNet 98 World Conference of the WWW, Internet and Intranet Proceedings. http://www.eric.ed.gov/ERICDOCS/data/ericdocs2sql/content_storage_01/0000019b/80/17/7a/21.pdf.

Laurillard, D. (2002). *Rethinking university teaching: a framework for the effective use of learning technologies* (2nd ed.). London.: RoutledgeFalmer. https://doi.org/10.4324/9780203160329

Lin, X., Hmelo, C., Kinzer, C., & Secules, T. (1999). Designing technology to support reflection. *Educational Technology, Research and development, 47*(3), 43-62.

Marshall, C. (1997). *Annotations: from paper books to the digital library*. Paper presented at the ACM Digital Libraries '97 Conference. http://www.csdl.tamu.edu/~marshall/dl97.pdf.

Petkovic, D., Lank, E., Ramirez , F., Raghavendra, S., Chen, F., Pekiner, C., et al. (2005, January 2005). *Asynchronous Multimedia Annotations for Web-Base Collaboration in Biology Education.* Paper presented at the SPIE, San Jose. https://doi.org/10.1117/12.586362

Phillips, R., Pospisil, R., & Richardson, J. (2001). The use of a QTVR image database for teaching veterinary radiology and diagnostic ultrasound to distance education students. *Australian Journal of Educational Technology, 17*(1), 96-114. https://doi.org/10.14742/ajet.1775

Suthers, D., Vatrapu, R., Medina, R., & Dwyer, S. (in press). Beyond threaded discussion: Representational guidance in asynchronous collaborative learning environments. *Computers & Education*.

Suthers, D., & Xu, J. (2001). *Kukakuka: An online environment for artifact-centered discourse*. Paper presented at the Education Track of the Eleventh World Wide Web Conference (WWW 2002). http://www2002.org/CDROM/alternate/252/index.html

van der Pol, J., Admiraal, W., & Simons, P. (in press). Peer evaluation in online anchored discussion for an increased local relevance of replies. *Computers in Human Behavior*.

Whipp, J. (2003). Scaffolding critical reflection in online discussions: Helping prospective teachers think deeply about field experiences in urban schools. *Journal of Teacher Education, 54*(4), 321-333. https://doi.org/10.1177/0022487103255010

Acknowledgement

This research was conducted under the supervision of Dr Damian Blake, School of Education, Deakin University.

Author contact details:
Meg Colasante
Academic Development Group, College of Science, Engineering and Health
RMIT University
Melbourne, VIC 3000
Australia.
Email: meg.colasante@rmit.edu.au

Please cite as: Colasante, M (2010). Future-focused learning via online anchored discussion, connecting learners with digital artefacts, other learners, and teachers. In C.H. Steel, M.J. Keppell, P. Gerbic & S. Housego (Eds.), *Curriculum, technology & transformation for an unknown future. Proceedings ascilite Sydney 2010* (pp.211-221). https://doi.org/10.14742/apubs.2010.2038