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Exploiting emerging video annotation technology and industry engagement to authentically prepare students for the complex world of work

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This paper reports on the benefits of integrating industry representative presence in building employment skills, in the context of learning with the aid of emerging video categorisation and annotation technology. An integral part of this process was inclusion of industry professionals, academic colleagues and relevant literature. In a multiple-case study design, a media annotation tool (MAT), was used to ‘bring’ the expert to the novice via video presence, video scripting, skill analysis feedback, and/or other learning support collaborations. Three case studies, out of nine that were examined using MAT for developing employability skills, are presented. Each involved industry input from commencement of the learning design processes to video production and to providing student feedback in MAT. These three cases, one postgraduate (Juris Doctor), and two undergraduate cohorts (Chiropractic; Medical Radiations), are presented along with their employability skills targeted for development, the specific industry input, and stakeholder feedback. Each case involved videos produced in-house based on real-life workplace scenarios, to tease out the respective employability skills of: communication and advocacy skills; clinical thinking skills; medical image evaluation and quality control skills. Data collection for all cases involved teacher observation and interviews, and artefact analysis. Additionally, the undergraduate cases included student data of pre- and post-surveys, observation and interviews, while the postgraduate case included industry representative observation and interview. Findings indicated that students largely valued the access to experts in their chosen field and appreciated the structuring of analysis categories by the teachers and/or experts within MAT to help them develop their thinking like an expert. Additionally, the teachers and industry representative interviewed noted the positive impact on developing employability skills and student engagement with key concepts for professional practice. Findings across the cases offered insight for next steps, such as offering additional cases for comparison to further consolidate skill building.

Keywords: Video annotation, community of practice, employability skills
Introduction

This paper reports on the benefits of integrating industry representative presence in building employment skills, in the context of authentic learning with the aid of emerging video categorisation and annotation technology. The technology used in our study, a video annotation system called ‘MAT’ (or media annotation tool), was an interactive tool enabling students to engage with media, primarily video. Video annotation allows functionality beyond basic viewing controls and general commentary in tools such as YouTube™ to enable students to add text entries directly to specific segments of video. MAT has additional functionality for the video-anchored annotations, of both categorisation and collaborative threaded discussion.

Employing a multiple-case study design, nine case studies were examined in their use of MAT for employment skill development, three of which are presented in this paper; Juris Doctor (postgraduate), Chiropractic and Medical Radiations (both undergraduate). Data collection involved observation, interviews, and artefact analysis, plus pre- and post-surveys, although the Juris Doctor case study does not include post-surveys. Each case presented in this paper involved industry input in the style of a community of practice. The three cases are presented with their employment skills targeted for development, their specific industry input, and respective stakeholder feedback. The findings of our research may be applicable to other video annotation software (e.g. VideoANT (Hosack, 2010); CLAS (Risko, et al., 2013)).

The role of community of practice in authentic learning

Learning about and building employment skillsets is an essential part of professional orientated programs in higher education. One way to approach this is through students engaging in simulations, which offer “appealing representations of reality” (Herrington, Reeves, Oliver, 2010, p.86), administered online, face-to-face or in blended modes to provide authentic learning experiences (Oliver, Herrington & Reeves, 2006).

Authentic learning is appealing… because it situates knowledge in realistic contexts, and it challenges students with realistic tasks, requiring them to think and problem-solve as they might in the real situation (Herrington, 2015, p.65).

While video can support authentic learning by offering access to the vocabulary of the industry and the performance of experts (Herrington & Parker, 2013), simulated events offered via video can provide specific workplace procedural representations. When augmented by student engagement with an industry representative, a novice student can learn from an ‘expert’ in a work-focused, learning community of practice. Previous studies have demonstrated that when the learning environment provides students with access to the skills and opinions of experts, they were able to compare this to their own thoughts and ideas (Parker, Maor & Herrington, 2013).

Communities of practice align to critical elements of authentic learning, that of providing “access to expert or professional knowledge, skills and attitudes in real-world problem solving” (Herrington, Reeves, Oliver, 2010, p.23), “investigat[ing] a problem or task from more than a single perspective” (p.25), and collaborative knowledge construction “through appropriate tasks and communication technology” (p27-28). Communities of practice help students to understand the nuances of professional understandings (Brown, Collins &
Duguid, 1989). Lave and Wenger (1991) analysed learning in apprenticeships and traced the development of understanding from the ‘novice’ to the ‘expert’ through engagement with situated activities and mentoring from a ‘master’. They highlighted the benefits of learning from membership of a community and the peripheral learning that results from immersion in the culture of an activity.

Communities of practice have been acknowledged as processes for sharing of experience and knowledge that fosters innovative approaches to problems (Wenger, 1998). For a group of dental hygiene clinical instructors, a community of practice facilitated effective changes in their teaching practice whilst contributing to a more collegiate working environment (Tax, et al., 2012). The potential for communities of practice to provide professional development opportunity for occupational therapists has also been recognised (Wilding, Curtin & Whiteford, 2012). Teachers, students and industry representatives can form a community of practice for effectively learning workplace skill sets. In the discipline of law an influential United States report, the Carnegie report, advocated for ‘apprenticeship-style’ learning in legal education, including learning from industry experts through practical legal experiences (Sullivan, et al., 2007). In Australia, Owen and Davis (2010) argue that communities of practice among teachers promote both general and law-specific graduate capabilities.

**Methodology**

A multiple-case study was conducted to examine the integration of a video annotation tool (MAT) to develop employability skills across multiple disciplines, funded by a university grant. While nine cases were examined in the project, three case studies are presented in this paper because of their intentional use of industry input in their higher education cohorts. The three cases under focus involved teachers, students and industry representatives in the learning processes, and are from the program areas of postgraduate law, undergraduate chiropractic, and undergraduate medical radiations. Each case used MAT in their respective work-relevant learning contexts.

Data collection for all cases involved teacher observation and interviews, and artefact analysis. Additionally, the undergraduate cases included student data of pre- and post-surveys, observation and interviews, while the postgraduate case included industry representative observation and interview. Across the cases, data references to expert involvement were used as the primary data for this paper. Table 1 includes a summary of both the data collection and professional engagement in MAT for the study.

The data collection instruments were pre-tested within a pilot study (see Colasante, 2011), and adjusted for contextualisation to the specific learning outcomes of each case in the multiple-case study. Data collection limitations included not being able to directly harness the student experience for the Juris Doctor case, nor the expert voices in the form of interview for the undergraduate cases, each due to timing and logistical issues.
Table 1: Data collection and professional engagement in MAT

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Community of practice students / teachers / experts</th>
<th>Data collection</th>
<th>Authentic video content</th>
<th>Expert input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juris Doctor (law) - Postgraduate</td>
<td>32 students 3 teachers 1 industry expert (practicing lawyer)</td>
<td>Observation and interviews: Teachers (n=3); Industry expert (n=1). General artefact analysis.</td>
<td>Moot court proceedings</td>
<td>Video input: scripting, acting; Guest lecture: ‘moot master’ talk; Feedback: on student analysis of video</td>
</tr>
<tr>
<td>Chiropractic - Undergraduate</td>
<td>78 students 2 teachers 1 industry expert (practicing chiropractor)</td>
<td>Observation and interviews: Teachers (n=2); Students (n=8). Student pre-surveys (n=39) and post-surveys (n=37). Artefact analysis.</td>
<td>Chiropractic consultation in two parts (patient history interview; clinical examination)</td>
<td>Video input: scripting, acting</td>
</tr>
<tr>
<td>Medical Radiations - Undergraduate</td>
<td>57 students 1 teacher 1 industry expert (practicing radiographer)</td>
<td>Observation and interviews: Teachers (1); Students (1). Student pre-surveys (n=36) and post-surveys (n=33). Artefact analysis.</td>
<td>Senior radiographer critique of a range of x-rays of upper and lower limbs (10 videos)</td>
<td>Video input: demonstrations while thinking aloud</td>
</tr>
</tbody>
</table>

Findings

In the three cases presented, an integral part of the implementation of MAT involved inclusion of industry professionals, academic colleagues, student cohorts, and relevant literature. MAT was used to ‘bring’ the expert to the novice via a range of learning support collaborations, such as video presence (demonstration or acting in authentic workplace scenarios), video scripting, skill analysis, and feedback (see tab.1). Each case involved videos professionally produced in-house based on real-life workplace scenarios, to tease out the respective employability skills under focus. Specific analysis categories set in MAT guided the students to structure their thinking upon expert mental models of working through the scenarios under learning focus.

Juris Doctor

The postgraduate Juris Doctor (JD) students used MAT to help them develop communication skills in advocacy. Student groups annotated a video of a moot, which is a simulated court
The aim was to develop advocacy knowledge and skills, such as the ethics of advocacy, persuasive argument, and court etiquette. Student annotations received feedback by a practising lawyer. This lawyer also performed the role of judge in the video and thus provided students the opportunity to further learn from an industry expert. Later, students used the understandings scaffolded in MAT to engage in face-to-face role-plays as advocates in a simulation played out in a court.

Figure 1 illustrates one JD student group’s interaction with the moot court video, attested by the many coloured annotation markers along the video timeline (also represented by the student-titled markers extending beyond the image frame on the lower right). The colour range represents the various analysis categories that were established by the JD teachers in consultation with the industry expert. These included ‘Introduction’, ‘Persuasive argument’, ‘Structure of the argument’, ‘Court etiquette’, ‘Ethical dilemmas’ and ‘Final submission’. These categories were chosen as they are proceeding components requiring particular skill development. The exception is ‘Ethical dilemmas’, which was deliberately included to alert students to find a ‘planted’ error and thus avoid any negative learning associated with showing ‘non-examples’. The law expert gave students feedback on their analysis of the moot court in MAT, as entered in the ‘Teacher Feedback’ threaded discussion panels across the six sub-components (or ‘analysis categories’) of advocacy.

One of the teachers interviewed explained the particular employability skill of advocacy that was targeted, and the sub-components that students needed to unpack. She explained:
One of the problems we’ve had is how to prepare students for this task of advocacy simulation and we envisaged that a mooting video where they could pick out those good and bad practice would prepare them for their own efforts on the day when they face the bench themselves… and the comments do appear to show a really good interaction with the [analysis categories] (‘Clare’).

The same teacher discussed the subsequent input of the law expert, in that:

later on… the industry representative, the Moot Court Judge… [in the video] annotated their [students’] annotations, so he gave them feedback from industry and then they finally at the end wrote up a journal reflecting [on this] (ibid.).

An example of feedback she pointed out was specific feedback to a student’s annotation, with the expertise of the industry expert actually adding to the student’s argument:

we’ve got the industry representative saying, ‘Good grounds for a report to the Legal Ombudsman. The trial could be aborted and the client feeling suicidal or homicidal or both. Be passionate but know the bounds (ibid.).

The effectiveness of the learning intervention was evident to another teacher within the final journal assessment piece. She noted it was:

actually a great opportunity for them to say, ‘Well I – I saw this mistake and I knew not to do it’, or, ‘I saw … what I should do and what I shouldn’t do’. So from a teaching perspective I thought it was a great learning opportunity (‘Abrial’).

She added that it might be even better if it were their own performances that they analysed in MAT. The JD expert (‘Hugh’) was also asked if he thought the approach of using MAT as a tool to analyse the video scenario was effective in achieving relevant learning, on which he replied:

Yeah I think it is. Mainly two reasons, one is this generation is fairly visual, and the second reason is it probably will have an impact on them than just getting comments on a paper (‘Hugh’).

**Chiropractic**

The integration of MAT in second-year undergraduate chiropractic was developed to help students vicariously link theory to practice early in their curriculum. This was normally not achieved until year four when students were placed in a clinical learning environment. Video learning packages of headache presentations based on real-life clinical cases were produced and included an actor-patient and a practising chiropractor. The videos were industry exemplars of history taking and clinical examination of various headache presentations. The scaffolding provided in MAT enabled the students to generate clinical notes and a working diagnosis of the patient presentation in the video-case. Unique within this case study was a two-cycle process using MAT to develop the students’ clinical thinking skills. An initial video (the patient history) guided how to think expertly about a patient presenting with a headache, using 14 case history categories to engage the clinical thinking process (see fig.2). The subsequent video (clinical examination) required student groups to set the analysis
categories from their short-listed differential diagnosis in their conclusions from analysing Video 1. This resulted in each group having slightly different analysis categories to work from, with teacher guidance for further thinking in situations that may have taken a spurious direction.

Figure 2: Chiropractic analysis categories, Video 1

The chiropractic students where asked in the post-survey to identify ‘What was it about MAT that was most helpful to your learning?’ From eighteen free-form responses, 6 mentioned the clinical situation and/or procedure, another 3 directly mentioned the expert, for example:

- “watching a real chiropractor”
- “viewing another chiro in practice”
- “seeing how an actual chiropractor dealt with a patient”.

When asked in another open question what was the most valued feature in their learning overall, of the 27 chiropractic responses given to this question, 13 directly mentioned the videos or the expert and/or the real-life scenario.

The role of the expert in the videos (‘Jack’) was emphasised during interviews, for example, one student noted:

the first video was just the doctor talking to the patient about all signs and symptoms, the case history that sort of thing. This one [the second video] we were given the physical examination, so examination of the head, shoulders and back, reflexes, sensitivity of arms and legs and that sort of thing (‘Chelsey’).
When another student was asked about the expert chiropractor practicing via video, he responded positively; he appreciated:

his line of questioning for elimination of more serious risk factors and those kind of things helps, and doing it in a calm and relaxed way without alerting the person to that he was… inquiring as to more sensitive possibilities was quite good (‘Luke’).

Another student had met the expert before and held high regard for him, saying:

He knows everything. And having him as the chiropractor in this video… [was like having him as] a chiropractor, lecturer and a teacher and it’s fantastic. He’s really good (‘Shohini’).

She continued by noting the benefits of being able to learn from him, because:

he’s not an actor, he knows what he’s talking about. He’s not just messing around and saying lines off a piece of paper, he knows what’s going on and it makes it more real… I have a lot of respect for… [‘Jack’], so yeah just seeing him in there talking about this, that and the other, it’s really good to know that he’s [accessible] (‘Shohini’).

One student noted the “ideal” for her would have been to directly see the expert in his clinical practice. However, when asked to compare limited access to an expert in the field compared to having a range of cases presented by video, the same student answered:

it would definitely help if… instead of showing one video, having a series of videos that you could go through with… different practitioners so being able to compare and see all the different sorts of patients and that sort of thing, that would definitely be helpful. Especially in the comparison between the way people approach tasks and situations (‘Chelsey’).

Another summed her appreciation in watching the video as having access to an expert presenting what actually happens in industry; that “it made it that more, I guess, realistic” (‘Tori’).

One of the teachers interviewed was asked whether the activities were true to real-life clinical scenarios. She responded:

that’s basically what we’re doing. So they’re sort of pulling it apart and having one of their first experiences in doing this... So this is probably their first experience at a diagnostic interaction even though they’re way pre-clinical. So they’re analysing their theoretical material, they’ve applied their clinical skills and analysed history and now, they’re using some of their theoretical material to come up with a set of conclusions and then their final conclusion (‘Isabella’).
First year undergraduate medical radiation students can find learning the skills to critique radiology images a frustrating experience. Due to time pressures in laboratory sessions, clinical teachers have a limited opportunity to demonstrate these skills. Given this, a subject was redesigned to integrate student analysis of the process online. A senior radiographer from a major hospital network was engaged to critique 10 radiology images of the upper and lower limbs. He (‘Henry’) was asked to slow down and think aloud as he was videorecorded. The resultant 10 videos served as models of ideal critique, were uploaded to MAT, and made available to the student groups to analyse and annotate the expert critiques. Artefact analysis showed that most students chose to work individually, however, could access group members’ annotations as desired. The analysis categories set in MAT reflected those used to critique radiology images in industry (see fig.3). The medical radiations teacher explained during interview the reason for the MAT intervention:

One of the areas that… first year medical imaging students struggled with was the critiquing of… our radiographic images. Students and qualified radiographers need to know this because they need to evaluate their films against a known set of criteria for acceptability so then the films can be put through to the radiologist, which is the medical specialist in the area that then writes the official diagnosis or radiology report or medical report. So we had an expert from the ‘XXX’ hospital, qualified radiographer… he critiqued the images that related to the radiographic projections that… we teach our students and the students need to perform during this semester… And the students were asked to review the critique and post comments (‘Antonio’).

Before analysing the videos, the medical radiations students were given the opportunity in the pre-survey to make general comments as a learner, and to which one student offered they would prefer “to discuss theory and questions face-to-face with experts”. This appreciation for expert input was not, however, lost in the MAT environment, as when asked in an open question in the post-survey what was the most valued feature in their learning, of the 24 medical radiology responses given to this question, 21 mentioned either the videos and/or the expert critique. Of the 11 who solely mentioned the videos, it is probable they were implying the critiquing/content regardless, albeit one specifically noted video as providing the medium to give access anytime to revise critiquing skills.
Value for expert access was further supported when the students where asked in the post-survey ‘What was it about MAT that was most helpful to your learning?’ Twenty-nine medical radiations students provided free-form responses, with the most common \((n=21)\) being able to see a professional critique of images. Example responses included:

- “listening to an expert critique images when I wanted to, at a convenient time, reinforced my learning”

- “having an expert critique radiographs and presented in a video format that was accessible anytime, and we could choose which part of the video we needed help on”.

A medical radiations student interviewed appreciated access to the expert modelling workplace behaviours in the video, that is, the radiographer critiquing x-ray images for quality of product, but he also thought that a good extension activity would be for the students to film their own critiques of x-ray images for peer review. He said:

> the best way for me to learn is to repetitively do something… all the work was sort of done for you I guess that’s really my point. He sat there and critiqued and it was all obviously correct. I pointed out in my annotation a couple of things where I thought he’d not quite located… [an alignment point]… This is a good resource I think in that you do get that opportunity to go over a critique that has been properly done and acquaint yourself, or familiarise yourself with a good example of what you’re trying to do (‘Oliver’).

**Discussion**

The findings from this multiple-case study indicated student appreciation of access to experts in their chosen fields and the structuring of analysis categories within MAT to help them think like an expert, albeit some wanted more scenarios (chiropractic) or ability to create own scenarios (medical radiations). Experts, with their accumulated experience in their relevant discipline areas, have a bank of examples and solutions to call upon (Razzouk & Shute, 2012). They can breakdown scenarios, recognise underpinning principles, and clarify the situation more efficiently, whereas a novice may be fixated on the surface level without breaking down the scenarios (ibid.). Providing professional examples and links to experts in MAT, as well as an example of breaking down their thinking into categories that experts use, helped students to model an expert thinking process within the various skillsets.

Although there were variations in discipline and adoption of MAT by each of the three cases, teachers and students largely valued the expert modelling of industry practice and how this was the next best option to actual experience. Additionally, the teachers and industry representative interviewed appreciated the ability of MAT to offer development of employability skills and reflection on important professional practice concepts. MAT provided a framework for text entries of student enunciations and teacher and/or expert perspectives, in a scaffolded format, supported by structured analysis categories and annotation threaded discussion panels anchored to video segments under analysis. The students critically reflected on practice and received others’ input to collaboratively construct knowledge.

The use of work-focused, learning communities of practice to teach professional skills provided the opportunity for authentic contexts of work-relevant practice in video and
supports that MAT can meet three critical elements of authentic learning. As aforementioned, these included: (1) providing access to experts and professional detail, (2) examining a scenario or problem from multiple perspectives, and (3) collaborative knowledge construction via applicable activities and tools (Herrington, Reeves, Oliver, 2010). These critical elements were met in different degrees across the case studies; Table 2 summarises the three communities’ interactions.

Table 2: Resultant Learning Communities of Practice Interactions

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Expert</th>
<th>Other students</th>
<th>Teacher(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juris Doctor</td>
<td>Vicarious (video scenario)</td>
<td>Dynamic (online group analysis of video)</td>
<td>Dynamic (face-to-face support)</td>
</tr>
<tr>
<td></td>
<td>Dynamic (feedback in MAT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiropractic</td>
<td>Vicarious (video scenario)</td>
<td>Dynamic (online group analysis of videos)</td>
<td>Dynamic (feedback in MAT &amp; face-to-face support)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Radiations</td>
<td>Vicarious (video scenario)</td>
<td>Vicarious (access to others analysis activities in group)</td>
<td>Dynamic (feedback in MAT &amp; face-to-face support)</td>
</tr>
</tbody>
</table>

For this study, the industry expert has been recognised to play a valuable role in the community of practice and to enhance student learning of professional skills. In particular, the students recognised the importance of the expert in their learning community of practice and the accessibility to an expert that such a community afforded; including the opportunity to observe application of skills and knowledge of the expert to real-world problems. Similarly, Quinn et al (2014) noted for a surgical journal club the importance of experts in the form of “senior community members” in providing access for junior members “to narratives of experience along with active engagement of junior members to allow them develop their own meaning” (p.606).

Conclusion

This study demonstrated that integrating online innovative technology, such as a video annotation tool, with industry representative presence in a learning community of practice with teachers and other students, can assist in the building of employment skills and building of key concepts for professional practice. Further work has included development and implementation of additional video-cases for comparison to consolidate student skills in work-relevant practice. Future directions include offering this approach across wider discipline areas that have professional learning outcomes.

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References


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