

Video-Annotated Peer Review (VAPR): Considerations for Development and Implementation

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Abstract

The knowledge associated with engineering education has grown considerably with efforts related to empirical research regarding the cognitive basis of learning and changes in student demographics and needs. Unfortunately, there has been a lag in the adoption of research-based teaching approaches by practitioners. At the same time faculty are limited in the development of their instructional practices to short courses, workshops, conference proceedings and publications. All of these developmental activities require substantial time, effort, and funding with no guarantee of application to the classroom and university context of participating faculty. In addition, faculty feedback is generally limited to student evaluations and periodic observations associated with promotion and tenure.

This paper describes the implementation of a video-annotated peer review (VAPR) process seeking to address a growing need to support the diffusion of research-based instructional practices and create a formative feedback process that will enhance faculty development. In support of the description of the VAPR process, this paper provides a review of diffusion of pedagogical practices, faculty peer-review, and social reflexivity theory.

Utilizing a qualitative design, a focus group of VAPR participants was conducted after the first round implementation to explore the benefits and limitations of VAPR. Findings from the focus group illuminate how VAPR overcomes common barriers to diffusion.

Introduction

The current academic climate consists of influences that require outcomes-based program accreditation, anticipated shortfalls in graduation rates, changing engineering student demographics and attributes, changes in engineering practices in developed countries, advances in instructional technology and cognitive sciences, and a movement towards the scholarship of teaching and learning¹. These forces place a large emphasis on continued faculty professional development, and a diffusion of research-based practices into the classroom as the engineering education community is increasingly recognizing the importance of proactively helping engineering educators advance their teaching effectiveness². Despite this, faculty members are expected to learn how to do everything their job requires by trial and error with some support from professional development programs¹.

Professional development programs are typically low in attendance when employed and faculty that do not attend indicate that the programs have low relevance to their own teaching^{1,3}. Felder et al. also indicate that many instructors are unaware of alternatives to traditional lecturing, as this is the way they were taught; they explain low student

performance and low student evaluations as a reflection of the student, and not of their teaching. A large component of this incorporation of alternatives is a perceived lack of discipline-specific examples, making it easy for faculty to dismiss professional development content as not being relevant to their own courses¹.

In an attempt to facilitate professional development, enhancing teaching effectiveness and the diffusion of research-based instructional practices, a peer review process developed by a university-wide committee was adopted and modified as the basis of a video-annotated peer review (VAPR) process. The VAPR process, in summary, involves participating faculty recording one of their class sessions, posting the video file to an accessible database, allowing other faculty and professional development staff to review the video while adding comments at specific timestamps throughout, and the observed faculty member subsequently reflecting on the comments.

The peer review process was selected as the vehicle to facilitate diffusion of researchbased practices and enhanced teaching effectiveness, as it is through this process that faculty share experiences in the classroom in real time; engagement in the process should provide a means by which participants share the best practices and provide constructive feedback on those practices⁴. The design of the VAPR process draws on the literature associated with diffusion, the use of video cases in professional development, and social reflexivity to limit the negative aspects of peer feedback and draw out opportunities of diffusion that are not readily addressed in current dissemination practices.

Diffusion of research-based and innovative practices

The term educational innovation encompasses new materials, strategies, or pedagogy⁵. These innovations are often developed as a result of empirical research studies. Borrego, Froyd, and Hall⁶ identify that the amount of research at improving engineering education over the past decade has yielded a variety of innovation, but unfortunately has not resulted in significant systematic change. Borrego et al. indicate that U.S. reports on the adoption of research-based practices only suggest limited success, indicating a need for alternative approaches to rapid dissemination that go beyond the typical publications, workshops, and presentations.

Henderson and Dancy⁷ note that systematic change is accomplished both from the environmental structure and individuals with respect to a prescribed and emergent approach (Table 1). For prescribed outcomes, the change agent knows upon initiating a change process what kind of behavior or mental states in individuals or groups are expected and sought, driven by the assumption that the change agent has the key knowledge needed to define the outcomes. For emergent outcomes, the end state, in terms of behaviors or mental states, is determined as part of the change process, with the assumption that those involved in the change have important information needed to define the outcomes⁷. When the individual is the focus of the change, the change strategy seeks to directly impact their beliefs and behaviors, assuming that they act of their own volition. An asynchronous video-based peer feedback system would place the

ownership of change on faculty through reflection of their own video and those of their peers.

Henderson and Dancy⁷ also believe that science, technology, engineering, and mathematics (STEM) education change agents strongly favor the individual and prescriptive category because it has persisted so long despite a lack of proven success. This is because it makes intuitive sense: faculty will use new instructional materials and strategies because they are convinced through empirical data showing that the new method produces improved learning over traditional methods (Table 1). While dissemination, especially the incorporation of modeling, is effective at increasing awareness and interest in research-based innovations, Henderson and Dancy⁷ note that it is not effective at changing practice. An alternative approach to encouraging change in practice is to encourage emergent outcomes, such as teacher reflection, as well as strategies that lead to structural change, including policy and shared visions. The VAPR process encourages both the reflection of faculty in learning communities that develop shared visions of curricular change.

		Table 1. Approaches to change process in <i>I. Disseminating:</i> CURRICULUM & PEDAGOGY	n academia (Henderson & Dancy, 2011) <i>II. Developing:</i> REFLECTIVE TEACHERS
Aspects of Systems to be Changed	Individuals	Change Process: Tell/teach individuals about new teaching conceptions and/or practices and encourage their use.	Change Process: Encourage/support individuals to develop new teaching conceptions and/or practices.
		Examples: dissemination/training, focused conceptual change	Examples: reflective practice, curriculum development, action research
	nmental Structures	III. Enacting: POLICY	IV. Developing: SHARED VISION
		Change Process: Prescribe new environmental features that require/encourage new teaching conceptions and/or practices.	Change Process: Empower/support stakeholders to collectively develop new environmental features that encourage new teaching conceptions and/or practices.
~4	iro	Examples: policy change, strategic	
	Env	planning	Examples: institutional transformation, learning organizations
	L	Prescribed	Emergent

Intended Outcomes

Studies of diffusion of research-based classroom innovations indicate that faculty are interested in implementing innovative strategies. A study by Dancy and Henderson (2010) indicates that 70% of all faculty in physics education were interested in change and 92% of the faculty reported that their departments were either encouraging or very encouraging about efforts to improve instruction. Despite this, participants indicated that they did not receive enough support from departments to incorporate curricular innovations. Similar results are seen in engineering education departments where deans indicated that they were aware of 82% of the strategies identified and that 47% of the chairs report use of the innovations^{6,7}. Despite this, Henderson and Dancy⁷ find that the

results of these self-reported implementations are significantly overestimated, and identify that the use or non-use of these strategies is not reliable.

Within STEM education as a whole, Henderson and Dancy⁷ indicate that the biggest barrier to improving undergraduate education is the lack of knowledge of how to effectively spread the use of currently available and tested research-based instructional ideas and strategies. Dissemination activities should place more emphasis on understanding the local environment in which instructors teach, as well as how the environments support innovation⁸. In addition, they should provide information and tools to anticipate possible implementation difficulties due to situational barriers.

From their pilot studies, Dancy and Henderson⁹ identify that the situational characteristics of an instructor's environment plays an important role in the nature of classroom instruction and that faculty often modify research-based instructional strategies. The difficulty in achieving diffusion of these instructional practices is that dissemination assumes that faculty will implement the innovation if they know of the innovation and believe in it. Unfortunately, Felder et al.¹ show that both deductive approaches that present and support findings with research, and inductive approaches that are self-discovered and proved, are needed. In addition, faculty adoption of the innovation can come with minor and substantial modifications⁹. Inconsistency can arise from transitioning abstract ideas and goals into concrete instructional activities⁸.

Faculty in these studies also self-identified additional barriers that primarily included situational constraints, such as student attitudes toward school, expectations of content coverage, lack of instructor time, department norms, student resistance, class size and layout, and time structure^{8,9}. Within engineering education, Borrego et al.⁶ concur with these findings, remarking that department chairs noted financial resources, class size, space technology, instructional staff time, and student learning and satisfaction as considerations to adoption. In their examination of faculty concerns regarding the implementation of innovations in engineering education courses, Turns et al.² identify three main areas that influence the implementation of innovations: consequence, personal, and management concerns (Table 2).

Consequence	Personal	Management			
Understanding how to use	Career issues (P&T)	Level of freedom & flexibility			
innovation		in using innovation			
	Self & work image				
Determining what		Challenges inherent in using			
mediates an effective use of the innovation	Workload	innovation			
	Managing perceptions of expertise	Identification of tasks			
	_	Types of resources needed			

Table 2. Influences of the implementation of innovations²

Turns et al.² observe that instead of simply understanding the technique, engineering educators struggled with impact concerns, specifically related to adopting innovations to

a particular situation and developing solutions to a specific problem of practice. This concern of the context of innovation implementation is echoed in Borrego et al.'s⁶ finding that differences existed among engineering departments when examining which researchbased practices were implemented by different departments, emphasizing the notion that the educational context and nature of the innovation may not always align.

Despite these barriers, faculty indicated that local colleagues that encouraged and supported the use of innovative practices supported their efforts⁹. The key to this was the recognition that someone else was interested in innovation and was there to help find resources, provide motivation, and provide a sense of acceptance for their attempts and the establishment of expectations for implementing innovations. The interpersonal networks play a key role in diffusion as there are similarities between members of the network allowing for a relatedness of the diffusion⁶. These networks can be further fostered through a formalized peer review process.

Faculty Peer Review

Peer review of teaching provides an alternate source of information for faculty and their supervisors to evaluate their teaching. Many faculty opinions and myths abound about student evaluations of teaching^{10,11} despite student ratings being found to be reliable¹⁰. The issues of solely relying on student evaluations of instruction are well-documented and additional data sources that provide context of course content and teaching effectiveness and assessment are required for a more complete faculty evaluation of teaching¹²⁻¹⁵.

Berk¹⁶ in his review of 12 approaches to gauging teaching effectiveness, suggests that institutions begin with student evaluations of instruction and then decide which distinct sources of information for formative and summative purposes should be used. While student ratings are necessary for summative and formative purposes, they are not alone sufficient. However, peer ratings used with student ratings can provide a more complete illustration of teaching effectiveness. An annotated, video-based peer-review system with self-reflection incorporated into the process would include three of Berk's 12 data sources for teaching effectiveness: peer review, self-evaluation, and videos. However, it is worth noting that Berk considers these in the context of employing rating scales rather than open-ended feedback and commentary. Thus, the institutional incorporation of VAPR into a teaching effectiveness program coupled with an existing student evaluation of instruction system would address a total of four of Berk's 12 approaches to gauging teaching effectiveness, conveniently encompassed by only two total systems.

An effective peer review process involves departmental and institutional leadership, formative and summative feedback, continuous improvement, a documented, standardized, and valued process, and timeliness¹⁴. Reflection, promoted by pre- and post-observation activities, as well as follow-up pursuit of ideas stemming from the earlier phases of the peer evaluation and instrument completion steps by peers are important for development and improvement of teaching¹⁷. The literature on student and peer feedback on instruction reinforces the need for fellow faculty feedback on their

peers' teaching. Input from fellow faculty also helps to complement student feedback due to the diversity, number, and quality of sources regarding a faculty member's teaching. This may thus lead to the faculty member paying more heed to the body of feedback and take action accordingly¹⁸, as the goal is to positively impact faculty teaching.

McManus¹⁹ cautions on the importance of establishing common ground between reviewing peers and the faculty being observed regarding teaching paradigm employed, learner-centered versus teacher-centered, prior to commencing the review process. Assumptions of the peer reviewers and faculty being observed when they follow different teaching and learning paradigms and have no awareness of these differences can result in detrimental effects on the peer review process.

Effective peer review that captures representative characterization of faculty teaching requires multiple observations, observers, as well as protocols and standardized data collection^{20, 14}. Lomas and Nicholls²¹ stress the importance of regular, cyclic, peer review of teaching for enhancing teaching and learning in higher education given consideration for critical factors such as faculty buy-in, and an acceptance of peer review of teaching as a tool for formative review and development, and not for summative review and gauging performance for personnel decisions:

"...peer review of teaching will be quality-enhancing if it is a formative and developmental process that involves collegial conversations and collaborations about teaching and not just peer judgments" (p. 145).

Needs- and context-specific models for peer review have been developed²², and in studying the application of their model, the investigators here caution on the delicate and potentially conflicting interaction between formative and summative functions of peer review as a teaching enhancement versus an assessment tool for personnel decisions. The authors stress the importance of allowing the faculty participants to make honest reflections and self-assessments and changes to their teaching. The inclusion of summative teaching evaluation in the peer review model can muddle the formative intents.

In a survey of literature on peer review in higher education, Blackmore²³, identifies best practices gleaned from the literature which includes participant training, varied observerobserved pairings, participant development follow up activities, triangulation with other teaching quality data sources such as student feedback, an open and transparent culture imbedded in the process, variety in instructional backgrounds of participants in the peer feedback system, and general transparency, fairness, and respect among and to participants (p. 224). In addition, staff should: be observed at least annually, observe one another, discuss experiences and practice, observe different types of practice, apply tools for reflection, and experiences should impact development plans (p. 226).

Using video recording to provide teacher feedback has been in use for decades^{24,25} in K-12 standard and vocational education teacher development. Web-based teaching portfolio videos for improving teaching in pre-service teachers through self-reflection in colleges of education have been employed as well²⁶. In a pre-service teaching system employed in a Japanese education program, teachers are shown sample videos highlighting various pedagogies and classroom environments. Pre-service teachers are then themselves video recorded in the field for methods and guided through selfassessment. The process of reviewing scheduled video-on-demand sessions is time consuming, but beneficial. Reviewing of video sessions has been used in promoting reflective practitioner teachers. Others²⁷ employing video in developing reflective practice in pre-service teachers have called for turnkey solutions to support the evaluation and reflection of teachers from their college of education faculty, employing technology to facilitate video-based teaching assessment. Similarly, pre-service teacher programs at other institutions have benefitted from the self-reflection and mentorship offered through videotaped teaching sessions of student teachers, but, "…further refinement is necessary, both in terms of procedures and instrumentation"²⁸. Chism²⁹ stresses the need for a practical process and makes suggestions regarding scheduling and realizing that visits in every review are not always necessary.

Web-based streaming videos with asynchronous peer annotations were used for preservice teacher training in Taiwan during field and micro-teaching sessions (n=36). The comments were linked to corresponding video segments. The instrument also provided for web-based dialog among peers and mentors. This is one of few examples of videobased and computer technology-driven peer-assessment approaches in teaching development. The tool developed provides, via portfolios accessed through login, a personal teacher, planning and instructional materials, a teaching video repository, video annotations linked to times, peer assessment (ratings by peers) for said videos, instructional materials prepared by pre-service teachers, and opportunities for reflection which can be set to be private or public by the user. The pre-service teachers showed overwhelmingly positive attitudes to the system and its benefits to improving their teaching and reflection. Agreement with nine questions ranging in topic from belief in the fairness of the system, benefits of peer assessment in improving teaching and reflection, to helping improve and increase preparation for lessons and generally favoring the online peer review system ran at 83-94% of participant pre-service teachers "Strongly Agreeing" on a 4-point Liker-type scale attitudinal survey³⁰.

A related effort to provide online, streaming web-based video review and annotation for pre-service teachers was conducted and studied by Kavas and Özdener³¹. The investigators cited a need to allow for review of teaching to occur in more convenient times outside of the standard teaching and work environment and customary workday. The investigators state that this need warrants investigating, "…how the web-based system may be employed to provide the opportunity for more practice by increasing the number of microteaching practices, to develop the assessment skills of teacher candidates, and to facilitate the establishment of communication among the students" (p. 1221). Pre-service teachers were randomly divided between control group participants and experimental group participants, where experiment group members participated in preparatory teaching videos subjected to offline peer teaching comments. Both control and experiment groups then performed microteaching and field teaching activities recorded on video. Microteaching and field teaching videos were then subjected to peer

and expert assessment. It was determined that there were no statistical differences between the two groups via t-test prior to their performances and it was established that both groups were normally distributed using the Shapiro-Wilk test. In Mann-Whitney U-Test comparisons of the rankings of assessment scoring in field teaching video recordings, the experiment group (n = 21) significantly outranked the control group (n = 21) in both microteaching and field teaching settings after treatment (U = 105.0; p < 0.05 and U = 64.0; p < 0.05, respectively). Thus, among several findings of the study, the experimental group pre-service teachers benefitted from the web-based video streaming peer review and outperformed control group pre-service teachers in microteaching and field teaching activities.

Whereas traditional and video-based peer review of teaching at K-12 pre-service teacher preparation pervades, and to a lesser extent calls for some form of peer-review in higher education settings, searches for streaming or on-demand digital video-based peer review systems produce few results in any teaching context, and those few that are unearthed are generally limited to pre-service K-12 teacher training.

Reflection and Social Reflexivity in Peer Review

The incorporation of reflective practices in professional teaching practice has been extensively examined in a variety of contexts, especially medical fields, K-12 education, and more recently engineering education³². While a large amount of the research has focused on the reflective practice of students to support learning, within engineering education, reflective practices have recently focused on collaborative efforts with learning science to promote the use of more student focused practices³³ and the use of journals as a means of reflecting on practice³⁴. The intent for these practices focuses on a critical self-reflection where the intent is to explore how considerations of power distort the educational process and to support the questioning of assumptions and practices that "make teaching easier but work against long term goals."³⁴

Reflexivity is the term used to describe the meta-cognitive behavior of reflecting on one's own actions or beliefs, the consequences of those actions or beliefs and then modifying future behavior to produce a desired result³⁶. However, in the fields of psychology, anthropology and sociology, there are several levels (or types) of reflexivity, ranging from reflecting upon one's own behaviors and beliefs, to how an individual's interpretation of the world around them is affected by his own experience "lens", to reflecting upon other's behaviors and beliefs³⁵. In Holland's synopsis of the several levels of reflexivity, level three best describes the process that faculty undergo as they review their own teaching, other's teaching and have access to the review comments of their colleagues' teaching: "This [definition of reflexivity] helps to contextualize individual processes within societal conditions. By definition, [it] involves cognitive, personal, or group "revolution" calling out psychological and social dynamics. A journey from the individual level to the social level is exemplified in social action psychotherapy. The process leads people out of individual distress into a social context of action. At the societal level of institutionalized knowledge case studies of theorists who have moved in the course of their development may identify the combination of sociopsychological

dynamics which fueled and channeled their destinies."³⁵ It is this level of reflexivity that is being termed Social Reflexivity.

In the context of peer review of faculty, social reflexivity is the process of being observed and peer reviewed, as well as peer reviewing others. This social reflexivity inspires selfreflection whereby the participants consider their own evolution but also compare themselves to their peers and their peers' evolutions. It is anticipated that the participants will increase their use of new and innovative teaching techniques, especially as they observe their peers and read the comments their peers receive for using similar, new techniques. It is hypothesized that the acts of being observed and peer reviewed will not be the only causes that affect the individuals' change, but witnessing the review of others and participating in that review will truly affect the biggest changes in the participants. It is this exchange between participation and cognition³⁶, shared among the participants, that results in social reflexivity, as contextualized by social psychologist, George Herbert Mead, in his description of the development of self^{37,38}.

VAPR Process

The development of VAPR began with the formation of a university committee at a medium-sized, private institution, during the 2010-2011 academic year, with the intent of institutionalizing a process of faculty peer review. The design of VAPR was guided by Chism's recommendations for peer review²⁹ and draws on the principles outlined by Marx, Blumenfeld, Krajcik, and Soloway³⁹ to guide the use of video-based cases for faculty development: 1) Cases are a way to convey the rich and complex nature of teaching; 2) Video should come from actual classrooms and not fabricated ones; 3) Teachers need reassurance to implement and try innovations; 4) Teachers need reassurance to support continued risk taking; and 5) Commentary and prompts associated with video help focus attention to particular issues.

The VAPR process focuses on the classroom observation of instruction; the review of course materials is not a part of the VAPR process. While a well-designed classroom observation provides a complementary evaluation of an instructor's pedagogical techniques (and their effectiveness in the classroom) to student evaluations⁴⁰, the VAPR process is anticipated to further enhance the review process by facilitating social reflexivity and the diffusion of research-based instructional practices. The following six-stage iterative process describes the VAPR process as it was implemented during the spring 2014 and fall 2014 semesters, and continues to be implemented (Figure 1).



Figure 1: The VAPR Process

The first stage requires faculty to select which of their class sessions to record for peer review using MediaNotes software. MediaNotes is a program owned by The Center for Computer-Assisted Legal Instruction (CALI). The program allows the user to tag videos with comments that are associated to specific timestamps. Permission to trial the software was obtained from the appropriate CALI representative. The faculty member under review (herein referenced as the instructor) is encouraged to select two sessions for peer review. It is recommended that one class session be from a course that the instructor consistently teaches and of a particular class session on which he would like a longitudinal review over multiple semesters. The second class session selected for review should showcase a particular technique on which the instructor would like feedback.

The second stage requires the instructor to reflect and summarize the perceived execution of the course. This pre-reflection will be completed by the instructor *after* the class session but *prior* to any reviews of the video. This approach allows the instructor to consider the course goals and learning objectives while situating the reviewer in the context of the class. A brief form is provided to the instructors to prompt them for this information, with input from the observed faculty member prompted as follows:

"Pre-Observation Analysis: Please create a synopsis of your goals for the specific class meeting you selected for review, with emphasis on specific teaching strategies you used. Ideally, this synopsis should be done as soon as possible after the class meeting has transpired to ensure accurate recall of events. You are

encouraged to comment on any issues or triumphs that may have occurred during the class meeting, to bring the reviewers' attention to them."

This reflection will later allow the instructor to compare their original intentions and perceptions to their actual execution of those intentions, encouraging a meta-cognitive element to the self-reflection (which constitutes stage four of the VAPR process). After the class session is videotaped, the instructor uploads his pre-observation summary and pre-reflection as the first comment (associated to video time 00:00) and then shares the files with selected reviewers.

At this point the reviewers may now observe and annotate the class session (the third stage). This video method allows multiple reviewers to review the video at their leisure and convenience. As the pre-observation summary and pre-reflection are associated to the 00:00 timestamp of the video, the reviewers see the summary before the video is played. As a result, the reviewers have the opportunity to familiarize themselves with the instructor's concerns, expected outcomes, and intentions for the class session prior to viewing the video as was intended by the pre-observation conference recommended by the university committee. This method of observation may alleviate the concern of the observer effect, wherein the presence of the observer affects the performance of the instructor and potentially the students²⁰. In addition, the faculty can choose a class that they deem typical, thereby avoiding a test period or other anomaly that would deviate from their normal instructional approaches. The faculty can also choose to delete the video before it is reviewed, if they decide it was not typical or simply are not comfortable sharing the video. The impetuses for implementing the VAPR method are to improve teaching and increase the usage of research-based instruction, not to evaluate teaching for promotion and tenure. Thus, it is not expected that faculty will misuse this benefit.

The VAPR process requires each faculty member in the learning community (LC) to review two other faculty within the LC (Table 3). As the feedback from a single reviewer observing a single class session can be unreliable and provides little useful information²⁰, the VAPR method provides a convenient vehicle for multiple reviewers to review multiple sessions. Muchinsky⁴¹ recommends a minimum of two different sessions be reviewed by two reviewers for any given course during any given semester. The two reviewers should review the same two sessions to address inter-rater reliability concerns and test-retest reliability concerns. To meet this recommendation, VAPR requires that each class session video for each instructor be reviewed by two faculty from the LC. Though the two reviewers may be different for the two video sessions (which differs from the recommendation), prior to any faculty reviews, a designated staff member with expertise in the field of engineering education also reviews every video (for a total of three reviewers per video) with the sole purpose of identifying innovative research-based practices within the video and opportunities for the inclusion of research-based practices (Table 3).

	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.	Inst.
	1	2	3	4	5	6	7	8	9	10
Peer Reviewer 1	-								2^{nd}	1 st
Peer Reviewer 2	1 st	-								2 nd
Peer Reviewer 3	2^{nd}	1 st	1							
Peer Reviewer 4		2^{nd}	1^{st}	I						
Peer Reviewer 5			2^{nd}	1 st	-					
Peer Reviewer 6				2^{nd}	1 st	1				
Peer Reviewer 7					2^{nd}	1 st	I			
Peer Reviewer 8						2^{nd}	1 st	-		
Peer Reviewer 9							2^{nd}	1 st	-	
Peer Reviewer 10								2^{nd}	1 st	-

Table 3: Sample schedule of peer reviewers for a single round of videos.

The sample table above shows how the LC faculty reviewers are assigned to review class sessions for the other LC faculty. Instructor 1 and Peer Reviewer 1 are the same person; for clarity the titles reflect their role. Each faculty reviewer is assigned to review two videos; one in which they are the first faculty reviewer and one in which they are the second. A second table could be created for the second round of videos in which reviewers are assigned to different instructors, or the same table could be used for both rounds of videos. It is anticipated that changing the assignments will enhance diffusion. If a more longitudinal evaluation of instruction is desired, the assignments should remain unchanged over several semesters.

The review performed by this expert ensures consistency across the reviews and provides expert guidance for both the instructor and the faculty reviewers. Additionally, each faculty member serves as a first reviewer and a second reviewer. As each video is reviewed by two faculty, the opportunity to improve diffusion and social reflexivity is afforded with each faculty member having the opportunity to be the final reviewer; this provides the benefit of seeing the comments from the previous reviewers. While the faculty's video is being reviewed, the reviewers can pause, rewind and insert comments. The MediaNotes software associates the comments to specific timestamps in the video, alleviating decontextualized statements and providing specific identification of opportunities to implement research-based practices.

Given the intent of VAPR is to support diffusion of research-based instructional practices and enhance teaching, it was determined that process would be most effective when the participants share an open and honest exchange of thoughts and feedback, without fear of a potentially negative impact on their promotion and tenure⁴³. For this reason, the evaluation form used as the basis for peer review in the VAPR process is notably void of any numerical rating system or rubric. This deliberate exclusion of a typical summative assessment tool is commensurate with the desire to maintain a formative feedback quality to the process and nurture collaboration. For the purpose of teaching improvement or enhancement, free-form comments provide useful and specific feedback for the instructor, whereas a numerical rating would fall short. The faculty and local center for teaching and learning (CTL) reviews are guided by a previously developed peer review form that identifies a table of attributes that include the instructor's organization, knowledge of subject matter, clarity and pace, atmosphere of the classroom, and professionalism (Table 4).

Table 4. Table of attributes to guide peer review

Instructor's Organization (*The instructor...*)

- presented the material in an effective, organized manner.
- presented the material at an appropriate level for the course and students.
- provided clear, concise examples and visual aids to clarify the material.
- used technology, to improve course delivery or facilitate activities.

Instructor's Knowledge of Subject Matter (The instructor...)

- illustrated command of the subject matter.
- presented material that was important and current.

Clarity and Pace of Instruction (*The instructor...*)

- defined new terms or concepts.
- elaborated or repeated complex information.
- made explicit statements drawing student attention to certain ideas.
- spoke in a voice in an audible voice with clear enunciation.
- avoided distracting mannerisms.
- spoke at a pace that allowed students to take notes, if applicable (PowerPoint or notes may be available)
- paused during explanations and after asking questions.
- provided explicit directions for assignments.

Instructional Atmosphere (The instructor...)

- conveyed enthusiasm for the subject and appeared engaged in the instruction.
- conducted the class so that students felt comfortable to ask questions.
- varied the tone and pitch of voice for emphasis and interest.

Instructor's Professionalism (*The instructor...*)

- arrived to class on time.
- answered questions respectfully, avoiding condescension, treating students with respect.
- dressed in a professional manner commensurate with the subject matter profession.
- appeared confident, demonstrated command of the classroom

The fourth stage requires the faculty to review their own videos with the comments of the CTL and their fellow faculty reviewers in the LC at specific time stamps. Following the reviews, the instructor then completes a final reflection (the fifth stage). This allows them to re-examine their original intent of the class, reflect on how their fellow faculty perceived the class session and reflect on their own performance. The prompt for reflection requests the following response:

"Post-Observation Reflection: Please read through the above comments by your peers. Upon conclusion, please reflect on your class and their comments in the space below.

Feel free to address the following: 1) Things that surprised you or gave you an "Aha" moment, 2) Changes that you will make to this course or others that you teach due to the comments or from what you saw in other reviews, 3) Things that you will maintain in your course, or 4) anything else that came to mind while reviewing the comments."

As identified in the literature on learning communities and video-based professional development, it is anticipated that following the peer feedback, the faculty will implement changes (the sixth stage). The VAPR feedback process is then repeated for the second round of class session videos. This entire process is repeated each semester.

Pilot Implementation

During the spring 2014 semester, VAPR was implemented in a first-year engineering department at a medium size, primarily undergraduate, private institution. Nine faculty within the department, including the department chair, followed the process previously specified, but for only one review round (i.e. each faculty was observed once and in turn reviewed two other faculty). The purpose of this first round implementation was to observe the implementation and to assess the critical reception of VAPR by the participating faculty. The following research questions address this purpose:

- What are the first impressions of faculty participating in a video-annotated peer review?
- What challenges did faculty encounter with the video-annotated peer review process?
- What did faculty perceive as benefits to the peer review process

Methods

Following the pilot implementation of VAPR in the spring 2014 semester, the nine participating faculty were requested to participate in a focus group to assess the pilot implementation. The focus group occurred at the beginning of the following fall semester, three months after the completion of the review, after a departmental meeting to prepare faculty for the upcoming semester. The duration of the focus group was approximately 30 minutes . The following semi-structured protocol was employed:

- 1. What was your overall impression of the review process?
- 2. What were some negative aspects of the process?
- 3. What worked well?
- 4. Did you find yourselves communicating after the review?

The nine participating faculty primarily teach courses housed within the first-year engineering department; however, several of the faculty teach outside of the department

as well and at the sophomore, junior, senior, and graduate level courses. The core courses within the department include introduction to engineering and the profession, introduction to computing and problem-solving, and graphical communications. Depending on the course and days observed, class times varied between 1 hour, 1.25, and 2 hour time blocks which faculty then reviewed. Participants included both tenure-track and non-tenure track faculty at academic ranks ranging from instructor to associate professor. Non-tenure track faculty are primarily responsible for teaching 12-15 credits per semester while tenured and tenure-track faculty are involved in research, which includes engineering education research.

Findings

Overall participants viewed the experience favorably, but noted some difficulties with some logistical and technological aspects of VAPR that have been noted as barriers to diffusion, especially time commitment. In general the pilot implementation supported the hypothesis that a community peer review process has the potential to support the diffusion of educational practices.

Overall perceptions of VAPR

All 9 participants indicated that the peer review process was well received. The intent of VAPR was to support self-reflection in an effort to recognize opportunities for improvement in practice while providing an opportunity for dissemination through a community of faculty and across course contexts. One specific participant identified their hesitation to implement inquiry-guided learning in their introduction to programming course:

"I enjoyed being able to watch the video and seeing people teach. Especially [Participant #1]'s class to see what was going on there and to see what you were doing and how you flipped the classroom and what you were doing. And this was in my original comments "Oh no its not going to work", but [students] just completely opened up the floodgates and how comfortable [students] were in the class and seeing how that worked.

This perspective indicates that VAPR has the potential to open faculty up to new implementations of research-based instructional practices in contexts that they may not have previously thought possible. This ability to support faculty's assumptions of practice is essential to the social reflexivity and critical reflection. Following the review of a colleague, another participant indicated that their prior assumptions about how that colleague taught did not align with what they saw.

"I was talking to [Participant #2] about hers [video] because it was not what I expected. You go in with one expectation of somebody that you have never seen and it didn't come out that way."

At the time, the participant being reviewed had been recognized for excellent teaching and viewed favorably among her students. Because the reviewer's assumptions about the teacher's practice did not align with what he saw during the observation, the incident provided an opportunity for critical reflection of not just their own practice, but educational practice as a whole.

In addition to these challenges to assumptions, VAPR provided an opportunity for faculty to identify practices that they could implement in their course. As hypothesized, VAPR provided the opportunity for a participant to observe a specific pedagogical technique in one scenario, reflect on the practice and the feasibility of its implementation in the observed course, and make a decision if they could implement that approach in their own course, thus supporting the diffusion of both research-based instructional practices, but also general pedagogical approaches. In the following statement the reviewer and Participant #2 teach different courses at the sophomore and junior level. However, the reviewer is capable of identifying an opportunity to implement the practice in their context.

"Then observed [Participant #2] and seeing how she gets wrapped up in the tangent to make the point and follow through. And it's always great, from a personal standpoint to just see what people are doing and say "Hey I can do this. This is something I can do"."

In contrast to these perspectives, one participant noted that the experience was "Overall good", but did not see much value for themselves in reviewing others. However this participant did express interest in seeing how other faculty perceived practices.

"I didn't get a whole lot out of the reviewing itself, but I'm kind of looking forward to seeing this summary. A summary about what everybody thought from their perspective. Because maybe I missed something."

This perspective alludes to an application of social reflexivity, where the participants can gain support and confirmation of alternative practices based on how they comment on others' work. At this time, it is not planned to permit the viewing of comments that were not conducted by the participant.

Challenges with VAPR

Several logistical and technological challenges were noted with the pilot implementation of VAPR. One of the principle issues was related to the length of course being reviewed. The course lengths for recorded classes varied from 1 to 2 hours depending on the course and the day the course was recorded.

[Reviewer #1]: "I have just one issue in the length of some of the reviews. Watching a two hour presentation gets kind of old."

[Reviewer #2]: "I will second that. Two hours is a long time to watch, especially when there is a lot of down time while students are doing stuff. Just sitting there waiting for that to process, because I don't feel like I can skip forward to where the instructor is talking again, just in case I miss

that one announcement. So seeing if there is a mechanism for cutting those chunks out or flagging them better."

When questioned if they experienced the same reviewer fatigue when reviewing a 1-hour course, participants indicated that this was acceptable. The MediaNotes software does allow for time stamps to be placed for specific occurrences and durations. In future implementations it may be beneficial for faculty to flag instances where there are breaks or long pauses in the class time. However, the ability to see experience gaps in activity or prolonged durations of lecture may add a reflective moment where reviewers can assess the proper time for students to work on an in class assignment or opportunities for one-on-one facilitation during that exercise.

Several participants expanded on this concern noting a "disconnect" from the classroom as the reviewer thus limited their ability to effectively review the course, especially when students were working.

"If you are a student, you can see everything including the board. The camera doesn't see the board and creates a disconnect."

"Hearing the students. Hearing what the students were saying was difficult."

Several of these issues were related to limitations in the software package being used for the review. All participants, when being recorded, were outfitted with a wireless microphone for clarity as they spoke. While this enhanced the clarity of the instructor's dialogue and those nearby, it also decreased the opportunity to clearly hear multipleperson dialogue, especially in large classrooms. For this study the majority of classes are small with no more than 35 students, with the exception of one large lecture than can support up to 200 students. After a review of these videos, it was determined that audio could be heard from the students, but it was difficult.

Another participant suggested including multiple cameras and angles so that you could see the projector screen, students, and instructor at all times. The limitations of the software prevents this from occurring and the use of multiple cameras would require extensive editing that would then limit the frequency and ease of the reviews. A fellow participant countered this perspective, noting that in some context seeing the interaction (unless using a physical model) was not necessary and that the important information for their review resided in the dialogue they heard between the instructor and the student.

[Reviewer #2]: "You need either two cameras or someone to operate the cameras, because I know for my video I wasn't even framed for about 90%."

[Reviewer #3]: "But I could hear you. You could hear the dialogue."

[Reviewer #2]: "You could hear me and that worked, but you couldn't see the interaction. "

[Reviewer #3]: "For you though, you didn't need it; you could hear what the student was saying and then the students turn back with you and it worked pretty well. Because all we would have seen was you bending over, pointing at the screen walking around. But I know your class, but you could hear it. ...I didn't feel like I was missing anything because you were very audible and I could hear everything that was going on."

The addition of further cameras also placed increased risk on disruption of the classroom; both in the extended setup and the proximity to the students. One participant noted that in some classes the rooms were too small and that even a single camera could be a distraction to the students:

"It was a really small room so the students were feeling the pinch of moving around where the camera was there. The tight classroom made the students close to the camera feel self-conscious about seeing the camera. The students that were in the front away from the camera did not have a problem. So it's not the camera, it's the back of the room moved around because of it. If there is a new way of hanging the camera on a wall or something out of the way that would be fine."

Further discussion regarding the camera in the room serving as a distraction to the students revealed that both the students and instructor generally forgot the camera was there within the first few minutes of the class session. Modifications to the camera location are being planned for future implementations, as is the request of instructors supplying supplemental documents, such as course slides and handouts, that reviewers can reference while offering feedback.

Discussion and Future Work

To address some concerns regarding peer review as identified by Lomas and Nicholls⁴⁴, the concept of video recording the class sessions and allowing the reviewers to annotate the video with their comments offers a solution to both increasing teaching effectiveness and supporting the diffusion of research based instructions practices and general pedagogical techniques across faculty and course contexts. The benefits of adopting this method of peer review include: 1) Annotating video such that the comments are synchronized with the events in the class session provides more meaningful feedback, as the instructor sees what the reviewer is referencing when forming their comments; 2) Multiple reviewers can review the same session at their convenience and leisure, eliminating time conflicts; 3) Multiple class sessions of the same instructor can be reviewed in quick succession for pattern identification or improvement recognition (comparison and contrast); 4) Previous semesters' sessions can be re-reviewed for a continuity review or evaluation of long-term improvement; 5) Instructors can review themselves and reflect on their own practices; 6) The intimidation that some may feel by having someone sitting in on their class is alleviated; and 7) The instructor has the final say on what class sessions are uploaded for review. This last benefit serves to mitigate the fears associated with classroom observations, including loss of academic freedoms;

Instructor discretion is thus especially important to encourage departments or institutions whose faculty currently do not perform classroom observations.

Due to the involvement of the department chair, CTL, and departmental faculty in the review process, it could be argued that all three of Gosling's Models of Peer Observation of Teaching⁴² exist, to some extent, in the VAPR system. However, the formative nature of the review and the lack of personnel consequences minimizes the role of the Evaluation Model (senior staff) in that the chair plays the role of a co-participating faculty peer. The Developmental Model (CTL) and Peer Review Model (peers) are most prominently applied in VAPR.

Future efforts will continue to implement the review over several semesters with the same participant cohort. Utilizing additional reviews, evaluation of peer review comments, characterization of pedagogical practices implemented during the observed course, and interviews, the effects of VAPR on the diffusion of instructional practices and increase in teaching effectiveness can be evaluated. This feedback can then be used refine and optimized the peer review process.

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