The Value of ICT from a Learning Game-playing Perspective

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Abstract

This study evaluated an Information and Communication Technology (ICT) case study in physical education teacher education from a student perspective. Action research evaluated the impact of a range of ICT options on student teachers' learning to play as well as learning to teach games in a secondary school context. Although multiple media were utilized during the games course, the study focussed on the impact of vodcasts (video broadcasts) on student learning. Drawing on evidence from an earlier podcasting (audio broadcast) study, the research sought to assess and compare the effect as well as the affect of an enriched multi-media delivery. Multiple data collection measures (such as survey, focus group interview, email, e-portfolio and instant messaging) indicated that the students, who identified themselves as visual learners, valued the vodcasts more than the podcasts, which had previously been described as "awesome". Although the overall rating for ICT, with the addition of vodcasting, was lower than the rate given to podcasting two years earlier, the students provided a strong validation for its role in enhancing learning.

Key words: Physical Education Teacher Education, vodcasts, survey

The demand for information and communication technology (ICT) in university instruction is now pervasive. Enhancing the quality of physical education teacher education (PETE) through e-learning has become a necessity in pedagogical interactions with today's technology-savvy students. Often referred to as *Generation Y* (The Media Group, 2009), *Net Generatio*n (Block, 2008) or *digital citizens* (Saltman, 2011), current students have expectations about the *what* and *how* of instructional course content. With i-pads and smart-phones now being capable of high-speed internet data access, university lecturers need to grasp this technological reality and use it both in and beyond the classroom. This paper builds on a previous podcasting (audio broadcast) study to explore the role of vodcasting (video broadcast) as a further learning enhancement.

A literature search on enhanced instruction through ICT has revealed an expanding use of various technological media in university teaching. However, the majority of 30 studies in Hew's 2009 meta-analysis of podcasting as pedagogy were limited to either the engineering or science field. Only a few studies have been undertaken in the physical education (PE) context: one on the use of earphones for teacher-related feedback (Fry & Koh, 2003), one specifically in the context of dance education (Block, 2008), another in teacher education (PETE) by McNeill, Mukherjee, and Singh (2010), and one on the electronic posting of video-clips (vodcasts) in school PE by Shumack and Reilly (2011).

In their analysis of the effects of podcasting, McNeill et al. (2010) identified audio provision as contributing to students' social and emotional learning. PETE students reported that, to a certain extent, they re-experienced the active participation in lessons when listening to the podcasts. Their students (n=20) rated podcasting as a pedagogical enhancement at M=8.8 on a 10 point scale with 30% reporting that they were "worth looking forward to" on an emotional level and a further 25% reporting the content as "awesome" (5s on 5-point scales) as related to its pedagogical underpinning. The main perceived value of podcasts was their utility: Seemingly audio-downloads allowed students to access previous lesson content while either travelling or exercising. In effect, evaluations suggested that students found podcasts to be an invaluable learning medium. McNeill et al.'s evidence identified the potential of podcasting as a social and emotional medium for strengthening the teacher-student relationship beyond the physical classroom. While Block's (2008) paper on dance and Shumack and Reilly's (2011) paper were written more from the perspective of how to use technology rather than the outcomes of their use, Fry and Koh (2003) evaluated the use of microphone and earpiece in providing real-time feedback to teachers in action. This study was undertaken to determine the responses of PETE students to an ICT-enhanced constructivist games pedagogy course, their preferred broadcast medium, and their perceived relevance and impact of ICT across the learning domains.

Methodology

Reported herein is a case study of an intact post-graduate initial PETE class learning to play games from a teaching/ pedagogical perspective, an extension of pedagogy previously evaluated (McNeill et al., 2010). The pedagogical purpose was to explore the use of video-clips (vodcasts) as an active pedagogy that complemented in-class teaching approaches and other online teaching methods. The specific research intention was to investigate the use of podcasts and vodcasts within that authentic context of learning to play and teach games. In other words, there was an inter-play between research and teaching. Thus, this section is divided into two parts: (a) discussion of the pedagogical approach to provide context for the investigation, and (b) details of the research methods.

Pedagogical Context

By its nature, the course (Principles of Games [PoG]) has been activity-based with various lecturers developing a theory-practice nexus in several ways, mainly through immersion in games-play with situation-specific class discussion, on-line posting of notes, and powerpoint slides (Blackboard©). Mindful of Kozma's (1991) recommendations about effective IT use that involve its speed, transformational qualities, and use of procedural information, as well as its facility to assist learners build understandings that help them become more like experts, the lead-author ("Mike", PoG coordinator and instructor) infused ICT into his teaching. In the semester of the current investigation, Mike supplemented his fundamental game-centered pedagogies through lesson notes,

emails, instant messages (sms), in-class video replay, powerpoint© presentations, e-portfolio postings, and lesson-by-lesson podcasts, the last of which had become a course feature of the learning support through the Blackboard© instructional system. He also explored his own and students' use of hand-held cameras to enrich his in-class and virtual pedagogy and included many of his video-clips as on-line vodcasts.

Mike met the students twice weekly (2 hours and 1 hour lessons) for 12 weeks. Sometimes the class venue was activity-specific, but often the sessions were held in an air-conditioned multipurpose sports hall, and occasionally the site was shared with another instructional group. He communicated with the students about up-coming sessions through email and instant messaging. The course covered elements of teaching games for understanding (TGfU: Bunker & Thorpe, 1982, 1986), Sport Education (Siedentop, 1994), Singapore's Games Concept Approach (GCA, Curriculum Planning Development Division, 1999; Tan & Tan, 2001), and Play Practice (Launder, 2001). The games concepts were taught through a wide range of sports activities, including soccer, basketball, hockey, rugby, netball, handball, mini-tennis, badminton, volleyball, sepak-takraw (a traditional South East Asian game akin to soccer-volleyball), t-ball, cricket and rounders as well as lead-up target games. Session-by-session, Mike designed small-sided games that were modified, exaggerated, and refined (Rink, 1998, 2006) in order to advance the students' content and content pedagogical knowledge (Shulman, 1987) of games play.

At the beginning of the semester, Mike asked the students to provide a written "sports resume" detailing their playing, coaching, and officiating experience (specific to sports, length and levels). By using these data lesson-by-lesson, he generated topic-specific groups and/or teams to meet his various pedagogical, social and emotional purposes. Combinations included heterogeneous (single- or mixed-gender) or homogenous (ability-seeded or single-gender) settings. At various times during the course there were short informal competitive challenges and a culminating round robin; for example, after a competitive badminton round the top and bottom men and women were paired up respectively in a mixed division handicap doubles. This brought both genders and layers of abilities together in a friendly competitive framework.

Mike reviewed the text of podcasts developed in prior semesters and edited to align them with the experiences of the current semester. He used 'Audacity' software to convert the written text to mp3-files and *posterous.com* to convert the audio recording for broadcast streaming. He took video-clips during almost every lesson to highlight the setting/set-up, action and outcomes of various pedagogical initiatives, with vodcasts as the most pertinent. (See Table 1 for a list of the weekly content topics and ICT used in the pedagogy.) Generally, Mike's podcast contained substantial pedagogical information which went beyond merely describing the activities: His intention was to inform the listener about the purpose of an instructional episode or a games-play experience, its pedagogical underpinning, as well as the progressions that were developed from this action. He frequently asked the listener questions in order to challenge traditional mindsets about small-sided games as more significant than developing technique as a basis for learning to play (and to learn to teach how to play). Mike's intention was to "improve professional practice … as well as enhance their professional competence in teaching, organization, administration and management and also recognise when the use of ICT would be less effective or appropriate" (Stratton, 2001, pp. 24-25).

Table 1. ***Weekly ICT Provision for Principles of Games Course***

Week	Content	Lesson Notes	Pods	Vods	Additional ICT
1	Invasion: Principles of support, pressure and awareness of open space (corner) - captain's ball	✓	1	2	powerpoint
2	Invasion: Game organisation (grids & bibs); Focus and sampling (soccer & frisbee)	✓	1	2	
	Invasion: Technical application through skill development (lay-up) - basketball	✓	1	2	
3	Net Barrier 1: Mini-tennis/pickleball	✓	1	3	
	Competition Ladder	✓	1	4	
4	Net-Barrier 2: Badminton i singles	✓	1	-	smartphones,
	Badminton ii Bench Coaching Mixed Doubles	✓	1	-	email/sms questions
5	Net-barrier 3: Volleyball - 2 aside model (Beach Volleyball)	✓	1	3	You-tube video
6	Invasion: Floorball - differentiated scoring & 4-aside team play	✓	1	-	
	Developmental hockey	✓	1	5	
7	Invasion: Basketball defensive principles	✓	1	1	Scoreboard-Player ranking
	TSAP Assessment (soccer)	✓	1	-	results
8	Striking/Fielding 1: Running & throwing bases	✓	1	-	
	Striking/fielding 2: T-ball space management & safety (8 groups of 4)	✓	1	5	
9	Striking/Fielding: cricket i	✓	1	-	
	Striking/Fielding: non-stop cricket/rounders	✓	1	4	
10	Target Games	✓	1	3	Ranking
	Developmental Rugby	✓	1	4	Results
11	Sport Ed. Handball	✓	1	4	Smartphones/ team collage
	Inventing Games	✓	1	5	email/sms questions
12	Course Test & Festival Finale	-	-	-	E-portfolio submission

Course presentation and resources. Because a key criterion of PE teaching effectiveness is the inverse ratio of teacher talk-time to student active-learning-time (ALT-PE: Siedentop, 1983), Mike sought to maximise activity. In 1997, the Singapore government introduced an education policy, entitled, *Thinking Schools Learning Nation* (see McNeill, Fry, Wright, Tan, & Tan, 2003), which has since driven a problem-solving approach to education in schools. In many ways, Mike's teaching in PoG embraced that philosophy: The course linked theoretical and practical content, but his face-to-face pedagogy was essentially practical through a social constructivist approach that drew on games-play. As course designer-teacher, Mike infused ICT (Cummings, 2001; Stratton, 2001) to maximise Academic Learning time in PE (ALT-PE, Siedentop, 1983). The purpose of fast-pacing the action of his lessons was partially connected to a belief that the intensity of prolonged small-sided games play can enhance aerobic and muscular endurance (McKenzie, Sallis, & Nader, 1991). In this way PETE students might learn that some aspects of physical fitness could be developed through games play.

During the dynamic action of his teaching, Mike used a light-weight digital camera (Panasonic Lumix, Model No. DMC-LX5) in order to capture high-resolution still-and video-shots. These were the basis of the vodcasts, which he often personalized to specific students through his purposeful voice-over during filming. The camera's built-in microphone also picked up nearby class dialogue.

His instructional intention was to not allow the technology to intrude into the active demands of games teaching, and there was no time for Mike himself to stand, outside the "play" of the lesson, behind a tripod-mounted camera. His underlying pedagogical purpose was to model the infusion of best practice ICT into PE teaching, and his principal motivation behind the research was to draw out PETE students' perspectives on the feasibility of ICT in school PE. There was no technical support during instructional time.

To conclude each session Mike facilitated a short debriefing discussion and within two hours of lesson-end he posted lesson notes on the Blackboard© e-learning site. These covered class content, and illustrated the sequential development of tactics, techniques, and concepts. Drawn from previous course materials, each podcast took approximately 1½ hours to prepare. Overall, Mike broadcast 21 podcasts on the same Blackboard© e-learning site, in order to explain the lesson purpose: how he selected the groups, ladders, and teams on a shifting pattern of information (some selected from lesson results and/or outcomes, and others from the personal demographics provided by the participants at the beginning of the course). In every lesson Mike also took short video-clips, during which he described the action. These captured various playing scenarios, including organisational patterns and settings, technical aspects of performance, and tactical play to concepts central to the GCA. To keep the vodcasts focused, he eliminated unnecessary footage. This broadcast material ranged from participant interview, organisational set-up, technical efficiency, tactical development, and conceptual probing. Except for the after-class interview, most class participants were captured in an authentic playing environment. The podcasts added personal meaning for those students featured in the videos. Of 67 video-clips captured in class, only 47 were broadcast on the Blackboard© e-learning site because some were of poor clarity, and the action in others failed to capture Mike's key intention for the session.

There was also an institutional requirement for student teachers to generate their own professional competency statement in the form of an e-portfolio (a web-based curriculum vitae). Thus, each student was required to post an e-reflection as part of the PoG assessment. They were asked to consider how the course might have had added value to their professional development.

Research Procedures

This case study was action-oriented in intent (Boud, Keogh, & Walker, 1985; Brookfield, 1995) whereby Mike adapted his camera-work through reflection on his teaching and students' on-going responses to the lessons. The two authors also met to discuss their interpretation of the students' views (the second author, Joan, was a participant observer in those classes involving student i-phone and i-pad applications). Applying constructivist learning theory (Richardson, 1997), Mike used planned aspects of group-based games pedagogy, such as "bench coaching" and "games creation" from "play practice" (Launder, 2001), and several characteristics of Sport Education (Siedentop, 1994). He also encouraged students to use their smart-phones to capture their own action in collaboration with a peer or group. Joan made written field notes while observing these sessions and posed questions to students during and after action. With Mike's endorsement, Joan also solicited email feedback on the smart-phone sessions to explore the links that the technology presented beyond traditional practice and to the level of satisfaction, as well as the challenges that this presented. In order to understand these processes from the IT-savvy students, questions were regularly posted on a Blackboard© discussion board. Mike also elicited emailed feedback on the nature of his ICT use, while Joan similarly encouraged PETE students to give feedback by either email or instant messaging (SMS) about the whole ICT provision, their perceptions of its quality and personal and social relevance of the how, when, where and what of ICT in games-related pedagogy.

Participants. This was a study of the interplay between teacher and students through the use of ICT. Profiled below are Mike, Joan and 33 secondary PETE students.

Teacher-researcher. Mike has over 40 years of games teaching experience (25 years in PETE following 18 years in secondary school PE). His own PETE program in the United Kingdom was grounded in movement education principles. His Master's program at Loughborough coincided with the early development of TGfU. As part of a minor program revision he designed this course to better align PETE with Singapore's national curriculum that mandates a games-centred approach to teaching sport. With his practical and theoretical insight, Mike has been developing and refining PoG since its introduction in 2005. In essence his underlying philosophy is that learning to play sports is most meaningful when contextualised in small-sided games. In line with Bunker and Thorpe's (1982) belief, game-play, even in its most simple form, is in itself motivating: His lessons have an emphasis on fun and enjoyment, yet must be both physically and intellectually challenging. Joan, a teaching and research colleague, assisted him with data collection and analysis.

PETE Students. At the beginning of the semester, their first in the secondary school PE initial teacher education program, the postgraduate students were all over the age of 21. Considered as adults, they were informed about the study purpose and research process and were told that they could withdraw from the study at any point during the semester by sending an SMS to the course instructor. Permission was specifically sought from them to vodcast segments of their lesson activity on the secured-access course Blackboard site. One student formally requested to have no video footage displayed. However, he willingly contributed all other data types and was randomly selected for an invitation to participate in a course-end focus group interview. The cohort (Tn=33) preparing to teach in Singapore secondary schools comprised 24 men and 9 women, all with varying backgrounds in sport and physical activity, including several current and former national players in badminton, dragon boating, hockey, rugby, canoeing, swimming, and cheerleading. One male student was absent from the final session of the course and another declined to complete the survey. Thus, a total of 31 (22 men, 9 women) provided survey data. Their current and former levels of performance ranged from inter-class to inter-constituency to national representation.

In terms of accessing the course online materials, which was not a course requirement, 10 students (32%) reported accessing all postings (notes, podcasts, and vodcasts). Although only four students (12.5%) retrieved no more than 25%, a mean rating of 3.8 on a 5-point Likert scale meant that close to 75% of the ICT was

reportedly accessed by the entire cohort.

Data Collection. Joan collected data on the students' class-interactions and their perceptions of the ICT support. These procedures are outlined below and summarized in Table 1. In order to reduce student impression management and potential threats to data quality, she also briefed students, collected data, and, as necessary, prompted students to respond to electronic data requests.

Field work. As previously stated Joan made field notes of observations. She had informal conversations during those lessons in which the students used their cameras.

Survey. For reasons of impartiality and instructor bias, Joan managed the survey procedures. A questionnaire was used to elicit the students' views. At the end of the course, after all assignments had been submitted and graded, the course participants were invited to contribute their views on Mike's use of vodcasting and podcasting in his game-teaching pedagogy in relation to its usefulness in learning to play and learning to teach games. The survey, derived from McNeill et al. (2010), had been trialled with another class for readability. It comprised 29 items, 13 of which featured a 5-point Likert-scale and one a 10-point scale. Most questions (N=16), pertaining to personal student perceptions of the impact and value of ICT, were either paired with a request for an explanation of the rating, or simply required a direct written response. A question on learning domains (cognitive-technical, cognitive-tactical, social, and emotional) was also included in an attempt to gauge the extent to which the students perceived that the ICT-enriched pedagogy might contribute to holistic learning. Respondent identity was not sought.

Focus group interview (FGI). A week after all class sessions were completed and students had submitted an institution-required course evaluation, every fifth student (n=6) on the class register was invited to participate in a focus group interview. All (3 men, 3 women) accepted, including one who had asked for his video segments to not be broadcast to the class. Joan conducted the session in a quiet meeting room. The discussion topics were selected to probe the survey analysis and observational data gathered during class sessions. A serious limitation to the data quality was that the students controlled the interview scheduling: timed on a day they were required to come into campus for a test. Thus, it was rushed and the participants seemed to have "their minds elsewhere": In the main, the comments were superficial: Only two (men) did not need prompting for a comment. The women were particularly reticent.

Email and instant message reflective prompts. Opinions were sought by posting a number of questions through e-mail on Blackboard including reminders by SMS. The questions sought to establish thoughts, feelings, emotions and feedback on the use of smart-phones in their Bench-coaching, Sport Education and Inventing Games sessions. Although initial responses were slow, a number responded in due course.

Eportfolio reflections. This cohort is the first required by the institution to develop an electronic professional portfolio to which each course has to contribute an artifact with a reflective prompt. These reflections were a compulsory component of assessment but not graded. However, after the semester had ended, Mike undertook a qualitative analysis of their content.

Data Analysis. Descriptive statistics (frequencies and/or means) were calculated for many of the inventory items. Following content analysis of the qualitative data (survey items, focus group interview, and e-portfolio reflections), perspectives from the various sources were combined in order to build a deeper understanding of the students' views on the ICT provision. The integrative analysis follows.

Results

This section is divided into two parts with the survey and interview data triangulated to reconstruct a rich picture of the students' views on their games-pedagogy course. The first part discusses ICT-digital media from their perspectives of learning to play games; the second part focuses on the ICT-media from the viewpoint of learning to teach games. However, at times these two perspectives are interwoven.

ICT and Learning to Play Games

Overall, the students were positive about learning to play games through an ICT-enhanced course. The mean (7.6, on 10-point scale) implies a strong satisfaction with the overall ICT-infused course. However, survey, focus-group, and e-reflections projected various interpretations of the digitally-enhanced games experience. The following sections address the ICT-media as a collective as well as podcasting and vodcasting as separate learning modes.

Satisfaction and usefulness. On a survey question relating to ICT provision in the "activity course", most students (N=11) indicated that the digital broadcasts were "enjoyable"; five reported that they were "worth looking forward to"; and only one person eported that the ICT platform was "inconvenient". In terms of the ICT material overall, their mean rating was 3.6, almost midway between "useful" and "very useful". The most frequent explanation for such ratings related to the ease and convenience of reviewing class material: Reportedly, the ICT enhanced recall and retention of class content. As was highlighted in McNeill et al.'s (2010) study the notion of *anytime, anywhere* was significant. Many students explained that the rewind facility was a significant benefit, allowing them to review class performance.

Impact of each medium. Overall the students rated podcasting (M=3.2) lower than vodcasting (M=3.8). When asked specifically which of the two was the more valuable, almost three-quarters (N=21) of the cohort nominated vodcasting (only 29 students responded to this question). To explain their preference, many commented on the powerful impact of the visual: From these students' perspectives, vodcasts contained richer information than did the podcasts. Furthermore, Mike's intention was reportedly more easily understood through vodcasting than it was through the podcast mode, of which one student wanted a transcript so that the podcast could be accessed by eyes as well as ears. It would seem that in reaching the vodcast through Blackboard, some students had failed to recognise Mike's descriptive paragraph alongside the "access" button, and claimed that vodcasting also needed the lecturer's voice-over explanation about what was happening on the screen. This last suggestion was also made in both the FGI and several e-reflections. Notwithstanding, one student in the FGI stated that there was deeper substance in the podcast than in the lesson notes. Of those who preferred podcasts, transferability to a personal digital device for easy listening was an asset. Some men noted that

the audio had a stronger reinforcing affect than did visual input and podcasts were reported as particularly beneficial in compensating for missing a class. However, two students described podcasting as "boring" or "draggy" with neither script in hand nor pictures to view; even one respondent described the podcast as "scripted and unnatural". It would seem that when provided with both media, the visual was much preferred, in contrast to students (McNeill et al., 2010) who, with no vodcasts for comparison, described the podcasts as "awesome".

Promoting games-sense. On the question as to what extent ICT specifically promoted "games sense" the responses were also positive (M=3.3). Overall, it would seem that these learner-games players found that the combined ICT package provided a comprehensive debrief of the concepts covered in class with one medium complementing the other. Many students' responses implied an understanding of Mike's instructional intention. One participant from the FGI commented that the podcast supplemented the in-class content where the lesson pace was reportedly so fast that note-taking was not feasible.

In terms of students' ratings of promoting games-sense, vodcasts were more strongly endorsed than podcasts. Vodcasts, intended to complement the podcast, had a more substantial impact on the class than did the audio. They presented meaningful content that depicted mistakes as well as successes, and several students used the cliché, "a picture paints a thousand words", to express the ICT's pedagogical utility. One reported that he had gained an "ability to review the performance of the activities [from vodcasts which was] … priceless." Another stated during the FGI that a vodcast was "an excellent medium of feedback to help us visualise what has been done." Only one person reported the value of accessing the webcasts in tandem: By listening to one and watching the other, she reportedly had a complete picture of what was being presented. In his comparison, a male student noted that the podcast was an important supplement to both the vodcast and the face-to-face learning with Mike. Another comment from the FGI stated that vodcasts (visual) and podcasts (auditory) were "mutually reinforcing." The major affirmation for the visual medium came in the way the students perceived it to enhance learning. They were reported as being "meaningful" (M=3.7, on the 5-point scale) to students as learners. Only one student reported that his personal comfort could be violated by vodcasting because he was not always comfortable being caught on video.

The postgraduates were asked for email reflections on their engagement in using smart-phones and i-pads during specific lessons. Their responses focused on the impact these devices provided for immediate troubleshooting, seemingly in the moment of the action of games-play. Students also reported an opportunity to capture hapless as well as happy moments, which were identified as captivating, while a link was made with improved performance and extra effort as a consequence of the filming which was seen as an influence in building a positive relationship with both the lecturer and their peer(s).

Analysis of 33 e-reflections identified many specific comments about various levels of engagement in a broad spectrum of game-related scenarios throughout the course. However, in spite of the intensity of ICT infusion in the games pedagogy, only one respondent highlighted the term "social" in the overview, and only three indicated the role of ICT in learning how to play. An attempt was also made to discern if the ICT pedagogy was perceived as either holistic or if any particular learning domain was more meaningful than another to the students. Only one student identified all domains: Thus implying his learning to be holistically meaningful. Over half the 52 total responses (54%, N=28) indicated that their learning was cognitive—tactical in nature. Over one third of the responses (36.5%, N=19) indicated that it was meaningful in the psychomotor (technical) domain; 7.7% (N=4) of the responses identified it as emotionally significant; and the man who reported holistically was the only student reporting learning to be socially meaningful. Two participants failed to respond to this item.

ICT and Learning to Teach Games

> This course highlights … the curriculum in a way that fits the lifestyle of the students these days. Living in a country where information and technology is a way of life, we can no longer fall back on the old 'whiteboard and marker' days. We need to constantly upgrade and use new methods of teaching; this includes using technology in PE classes. The introduction of technology into PE classes astonished me. Never did I know that technology can reach out to the different needs of the learners. Visual learners will be captivated by the videos that can be shown during lessons to enhance understanding. The use of their phone cameras to video lessons which they think are valuable and worth re-capping. The lesson is made more interesting and engaging in this way because we are using a real-world context to connect with the students.

The above excerpt from a female student's e-reflection captures her awareness of the essence of Mike's philosophy in designing and implementing his ICT-infused games course. The following discussion highlights the potential the students themselves saw in ICT pedagogy.

ICT-usefulness. Some participants had made comments on ICT for school PE within their responses about its relevance in their own learning to play. ICT was especially noted for capturing learner interest because students reported that such a visual representation was important for developing conceptual subject matter (central to constructivist games pedagogy). The mean response (3.6, on 5-point scale), to a question about the extent to which ICT provision developed pedagogical understanding, fell between "somewhat" (3 on the Likert-scale) and "a great deal" (4). The vodcasts had reportedly also addressed class management, an essential for novice games teachers; for example, one student reported that he could see "how we can organize space and equipment for the lesson."

Universally the students acknowledged that vodcasts were highly impactful (M=4) on them as games teachers. In many cases their explanations were reflections of how they had reported the visual medium as significant in their own learning to play; for example, it would be as a possible benefit for pupils e-viewing in their own time. It was reported that video-clips also allowed PE teachers to critique more meaningfully the performance of their pupils; to identify their common mistakes and clarify them in order to promote a clearer understanding. Multiple comments centered on PE teachers being more purposeful and better able to target their planning, if they were to video student performance in class

for post-lesson review.

In addition, the students were asked, in the survey as well as the FGI, to suggest ways that the ICT could be enhanced as a pedagogical medium in the games course. Some wanted the lecturer to present vodcasts during the lesson debrief, as an appropriate ICT lesson closure. Again a student requested that subtitles be added to the vodcasts to increase understanding. Another suggested that there should be an ICT-related assignment to further the role and function of these media, and the vodcast file be compressed for faster downloading. Characteristic of a product of the high-stakes testing-driven Singapore education system (Fry & McNeill, 2011; McNeill & Fry, 2010), one student suggested including regular testing on the pod/vodcasts to ensure that everyone accessed them on a regular basis. In order to assert the importance of the broadcasts, it was suggested that a videolog (journal) could be an assessment requirement. Students criticized the internet platform (Blackboard ®, Version 8) because of slow navigation and that the university does not adequately support Apple ® users. One student's suggestion was to assign a dedicated camera operator for each lesson; thus, the students would gain first-hand experience in handling the ICT. The students also expressed wanting to play an active ICT role in generating their own vodcasts and using them as a quiz to extend learning beyond the sports-field (classroom). Using ICT for assignments was by far the most common suggestion raised across the data collection measures.

Asked about ICT in their future school PE pedagogy, most respondents were very positive (M=4). Their explanations included: aiding motivation when pupils see themselves in action; conducting on-line research to upgrade their knowledge prior to class or game-play; showing pupils their performance in a self-improvement spirit; using videos to enhance learning through specific individual feedback; linking PE and home life; teaching concepts through ICT in order to reduce in-class explanation and debrief; and using webcasts to increase conceptual understanding. Many suggestions included the relevance of ICT for the individualization and differentiation of instruction. However, one student offered an appropriate caution that not all schools had the capacity to support ICT in PE.

Several suggestions were made when the students were asked for ideas on how to improve vodcasting. Some related to either digital devices or internet platforms. They proposed more general details about the lesson concepts and greater involvement of the students in capturing specific technical and tactical visual data. Other ideas such as setting up a camera (similar to fixed security surveillance) in every sports facility to capture each entire lesson and then for the lecturer to edit, sub-title, and voice-over were not necessarily feasible. The implication is that, although they might be members of an IT-savvy generation, these students had little experience in, and thus little understanding of, the time required to produce broadcast-quality material from data generated in class. One student recommended setting an ICT assignment in place of either the end of semester test or the course assignment.

The students' mean rating of the ICT as a collective pedagogical package was 3.8 on a 5-point scale. (Five students failed to respond without explanation.) The following e-portfolio comment from one of the men, captures the spirit of their pedagogical "take-aways":

> The podcasts and vodcasts provided after every lesson was [sic] a great way to capture all the learning points in that particular lesson. To have either audio or visual feedback on individual and group performance provided a platform which was easy to access, and could be viewed or listened to at our own time and convenience. There is definitely something in this that could be incorporated into PE lessons in schools, although the challenge will be in identifying how and when the use of ICT could enhance the value of the lesson.

Discussion

In determining the responses of pre-service PETE students to this ICT-enhanced constructivist games pedagogy course, several issues were raised in regard to their preferred digital broadcasting medium and what the students saw as the relevance of ICT for school PE (from Grade 1). These are related to the participants' reported responses being mainly conceptual, frequently gendered, seemingly blasé and pedagogically naïve.

As in many PE curricula worldwide, the Singapore syllabus has holistic intentions for its students, and although Mike's pedagogical process was in line with this, only one student identified his learning as meaningful across all learning domains. A possible explanation might be that although the PoG course was about learning to play and learning to teach, the students identified much more in learning to play—in building their own games sense, what Griffin, Mitchell and Oslin, call developing "concepts and skills" (1997). Indeed the fact that the cognitive and psychomotor domains were identified as personally relevant by over 85% of the cohort suggests that this inference might be valid. It appeared that there was little perceived connection on the social and emotional level made by the students to the ICT resources. In a previous podcasting study, McNeill et al. (2010) reported considerable evidence of the affective impact of podcasting on the learners, but such was not the case with a similar resource, personalised to draw on this cohort's experiences. Even the visual impact of seeing her/himself downloaded to screen, drew comment from only one participant.

Another detail that emerges from the social evaluation was related to the personal demographics provided by each participant. Underpinning all of this was the strategy of social bonding, mixing around and promoting a wider circle of camaraderie and sportspersonship. Again this had significance for an earlier group, but went without comment in all data sources from this study.

A somewhat disappointing finding was the volume of accessing ICT resources (podcasting and vodcasting) being lower among the current group. In this study, 13% listened or watched around a quarter of all broadcasts, 26% accessed about half, 29% about three quarters and 32% accessed all items. Furthermore, the reported satisfaction of the ICT experience (M=7.6 on a 10 point scale), fell short of the earlier study which had an overall rating of 8.8 on a similar scale. These reported figures may have several explanations. One reason could be that, as digital citizens, these PETE students may be either IT-blasé about the relevance of ICT provision in a games course or IT-overloaded if course-work digital communications are in competition with the students' own social digital networks. Furthermore, what might be construed as "coolness" to the media, relative to students in a study previously reported (McNeill et al., 2010), itself might be an indication that the students were unaware of the preparation time needed for

quality broadcasts and symptomatic of their pedagogical naivety. This reasoning has further support in the superficial suggestions made for improvement (of which many suggestions were already examples of Mike's ICT practice from their own course) and their lack of reflection in responses to email feedback questions.

Conclusion

Digital-age students appreciated ICT-enthused games-pedagogy, but seem to judge teacher-produced material on the same criteria to which they might rate commercially-developed resources. Needless to say, keeping abreast of resources, and digital applications relevant to this field is demanding. In the context of a naturalistic design, observation, interview, survey, e-journals, and e-mailing have elicited rich data on which to evaluate PETE students' responses to ICT-enthused games pedagogy. Although attempts, such as conducting the FGI after all assessment tasks had been submitted, were made to reduce the power impact of Mike as instructor researcher, his role is a limitation to the study. Ongoing data collection with multiple levels of triangulation might well have "burnt-out" the participants in their willingness to consider each request and some on-line tasks might well have structured the ways the students perceived themselves in relation to the course.

Both PETE and research on PETE need to keep pace with rapid developments in ICT that may be harnessed to enrich pedagogy. Institutional investment in technology must be sympathetic to the student as an ICT consumer; for example, the recent resurgence of the Apple ® platform must be taken into consideration. A future study on the use of ipads ® and tablets in the lesson debrief/closure has research potential. Yet, without technical support during lessons, some research is not feasible, unless students themselves are drawn into the data collection and analysis process. Ethical considerations, particularly power relations, need considerable accounting if the proposals put forward by these Singaporean PETE students are to be tested in terms of their practicality. Notwithstanding, the facility of post-lesson playback was found to be engaging and had the potential to add personal meaning to the value of physical activity and sport in the participants' lives.

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