Title of manuscript:

A video-based learning activity is effective for preparing physiotherapy students for practical examinations
Introduction

Active learning theory suggests that students have better learning outcomes when they are actively engaged in the learning process [1]. Indeed, health educators are challenged with providing learning experiences whereby students have the opportunity to construct new knowledge, rather than simply being taught. Videos present a promising method of providing such experiences and have been used effectively in clinical education [2-4]. Furthermore, video resources offer students flexibility in their learning approach and have the potential to ‘free up’ classroom time to devote toward active learning methods [5]. Indeed, there are several recognised benefits of videos for teaching current health professional students including enjoyment and engagement [6], increased authenticity of clinical events [7], and learning via a medium more familiar to their communicative upbringing [8]. A modern approach is particularly necessary given that today’s students are ‘millenials’ who favour information delivery via a range of media and value ‘aesthetically appealing presentations’ [9]. The use of video-based learning approaches in physiotherapy education in the context of practical examination preparation, however, has not been fully investigated.

Curiously, assessment preparation activities tend not to reflect student-focussed approaches, but rather are more commonly conducted in a didactic manner. Particularly in health professional education where high stakes assessment tasks are included in curriculum, such as practical exams and clinical placements, a more thorough approach is warranted. Concerted and carefully-designed learning activities that engage students in assessment preparation are likely to result in positive learning outcomes. Certainly, student-centred activities that elicit prior knowledge, create cognitive dissonance, apply knowledge with feedback, and facilitate reflection are important to the success of a constructivist learning approach [10].
The aims of this project were to explore physiotherapy student perceptions of the efficacy of a video-based learning activity for the purpose of viva preparation and to determine subsequent performance outcomes. We expected that students would be supportive of the new approach and would recognise the benefits of its inclusion as a learning activity. Further, we hypothesised that VIVA grades for the current cohort would be greater than those for the previous cohort (unsupported by the video-based session).

Method

Participants and Setting

Students enrolled in a first year course (n = 62) of a two-year graduate entry Australian physiotherapy program were invited to participate in the study. The program adopts an integrated model of clinical education, with students attending clinical placements interspersed throughout their academic calendar. As is typical of many physiotherapy programs, in order to be confident that students are prepared for clinical placement, and therefore able to practice safely and competently, students are assessed on their ability to perform in mock clinical consultations known as VIVAs (or practical examinations).

Information about the study was broadcast on the course website at the beginning of the semester to notify students that a research project was planned. Students were provided with an information sheet and the opportunity to ask questions before giving written informed consent. Ethical approval to conduct the study was obtained from the Human Research Ethics Committee (Approval number: PES/17/11/HREC).

Video-based learning activity
A new learning activity was delivered to all students \((n = 62)\) in the tenth week of the thirteen-week semester. Two clinical cases were constructed (i.e. in VIVA format) – one cardiorespiratory-based and the other neurological-based. Example VIVA questions were developed for each. A new-graduate physiotherapist was filmed performing both VIVA scenarios in examination format, led and assessed by an experienced examiner. For each scenario, the new-graduate was given a small amount of coaching so she could perform one VIVA at a level that could be considered good-excellent and another at a less satisfactory level to produce four individual video-based VIVA examples (each approximately 20 minutes). To maintain assessment standards, each video example was assessed by a consensus panel of experienced examiners [11] including one academic staff member and one external clinician (i.e. senior physiotherapist). Panel mark sheets were completed and stored digitally for later use.

A two-hour workshop was developed to incorporate and present the video examples and to engage students in preparation for their VIVA examination. Held almost three weeks before the VIVA examination, it served as a method of actively communicating assessment standards using multiple exemplars [12] and included six important components: a) an overview of assessment objectives, marking criteria and mark sheet; b) videos viewed and assessed by students using the criterion-based rubric; c) discussion between students regarding the marks they awarded; d) presentation of panel marks and discussion between students and staff in error checking; e) formulation of strategies for improvement of student performance; and f) question time.

Using this approach, students were clearly communicated the objectives of the assessment task including the criterion-based marking sheet and how the marks would be applied. The video examples were used to evoke prior knowledge, but also to create dissonance through the assessment of varied performances. Discussion around error-
checking and formulating potential strategies for improvement was a key element of the activity. This gave students the opportunity to hear from the panel as to why they awarded the marks they had, and to formulate in tandem with the panel, potential learning strategies for improvement. Given that reflection is critical to work-based learning and clinical practice [13] and an important element of constructivist learning [10], students were given time to reflect on the activity prior to the VIVA. Reflection was further encouraged by making videos (with panel mark sheets) available on the course website for future independent use.

Evaluation

In order to corroborate and adjust our initial plans to develop a video-based learning activity for VIVA preparation, we surveyed students in the first week of the semester using a five-item written survey with responses made on a five-point Likert scale (strongly disagree to strongly agree) (Figure 1). Questions were intended to provide insight into student perceptions around the use of videos to support their learning and whether they saw the approach as beneficial to their VIVA preparation.

To determine the impact of our initiative, we marshalled evidence from a variety of sources in order to garner a rich understanding of our outcomes. Following the new learning activity and the associated VIVA assessment, we evaluated student satisfaction using an eight-item written survey (five-point Likert scale) (Figure 2). Students were additionally invited to participate in a focus group in the week following exams in order to explore their perceptions of the new approach. Participants were encouraged to respond to a series of six core questions (Figure 3). The focus group was led by an independent staff member not involved in teaching. Responses were recorded using a digital audio recorder. To ensure
data familiarisation, the audio track was transcribed by both investigators, one initially, then the other to cross-check for accuracy.

In order to quantify students’ initial evaluations of the example VIVA performances, we collected mark sheets for each example. Student marks were later compared with panel marks using a one-sample independent t-test. Finally, student VIVA performance was evaluated by comparing participant VIVA grades with those of students in the previous year’s cohort. Viva preparation for the previous year was identical to the current year in terms of planned content, number of practical class hours, and allocated clinical skills practice time; however, the video-based preparation workshop and associated web-based materials were not included.

Data analysis

Survey data was interpreted on the basis of tallied positive and negative results and identifying the median response score for each item. Focus group transcripts were coded independently by both investigators and subsequently analysed for emergent themes using NVIVO version 9.2 (QSR International, Doncaster, Australia). Analyst triangulation was used to aid credibility and both investigators were experienced physiotherapy educators. Thick description was employed during coding stages to maximise transferability, while disagreements were settled by investigator moderation and themes were generated whether positive or negative. An independent samples t-test was used to compare VIVA marks for the current cohort with those of the previous cohort (unsupported by the video preparation activity). A one-sample t-test was additionally employed to compare student-awarded marks with examiner-awarded marks for each VIVA example. Quantitative analyses were
accomplished using SPSS version 19.0 for Windows (IBM Corporation, Somers, NY, USA) and results were considered significant at \( p \leq 0.05 \).

**Results**

**Student sample**

Sixty-two physiotherapy students participated in the new learning activity. Sixty students (60/62, 97%) completed the first survey, fifty-five students (55/62, 89%) completed the second survey, and eight students (8/62, 13%) participated in the focus group.

**Survey 1 – Initial attitudes to video resources**

Students were very supportive (98% positive) of the use of video resources to aide their learning (Table 1). Students were ambivalent, however, when asked if video resources had been used extensively in their program to date. Very positive responses were received when students were asked if: video demonstrations of VIVA examinations would be beneficial to support their VIVA preparation (95% positive); if rating such demonstrations would be beneficial to support their VIVA preparation (83% positive); and if video examples placed on the course website would be beneficial to their learning in the course (98% positive).

**Survey 2 – Satisfaction of the video-based learning activity**

Students were very satisfied (93% positive responses) with the new video-based VIVA preparation session (Table 2). Specifically, students felt the video resources were
effective to support their learning and that rating the video examples of VIVA examinations was an effective learning activity (98% and 96% positive responses, respectively). Viewing the video examples was seen to be beneficial to support their VIVA preparation (98% positive) and rating the video examples improved their familiarity with the marking criteria and the learning objectives of the VIVA (93% positive). Students suggested that the video examples improved their confidence in the VIVA (95% positive). Although 73% of responses were positive when asked about access to the video resources on the course website, 20% of responses were neutral, and 7% of responses were negative. Overall, students enjoyed the VIVA preparation session (93% positive) and felt that it should be employed in future courses (98% positive).

**Focus group findings**

From a thematic analysis of the focus group transcript, comments were first identified as supportive or critical. The following sub-themes were identified from the two main themes: **Supportive** - (1) Accessible; (2) Understanding; (3) Reduced anxiety; (4) Enjoyable; (5) Good timing; and **Critical** – (6) Predictable (Figure 4).

A content analysis of the themes and subthemes (Table 3) highlighted the preponderance of supportive impressions. Supportive references totalled 77 of the 90 coded responses, while critical comments totalled 13. Of the five supportive sub-themes, *improved understanding* represented the greatest text coverage (15.9%), followed by *reduced anxiety* (9.2%), *accessible* (4.0%), *enjoyable* (3.9%), and *good timing* (2.9%). The only identifiable sub-theme from the critical comments related to the *predictable* nature of the example performances, representing 8 of 13 coded phrases and 7.0% of coded text coverage. The
following is an account of the sub-themes identified from the focus group contributions illuminated by verbatim examples.

Sub-theme 1: Improved understanding

Student responses suggested that the new learning activity improved their understanding and familiarity with various aspects of the VIVA and the expectations surrounding it. In particular, students reported improved understanding of the objectives and guidelines of the VIVA assessment as well as a clearer appreciation of the nature of achievement standards.

“You can see the depth in the questions and the depth required in your answers.”

“We got more familiar with the criteria sheet and which boxes [on the criteria sheet] corresponded with which parts of the performance”

“Helped us understand what the expected standards actually are.”

Sub-theme 2: Reduced anxiety

Some students suggested that the video-based preparation session reduced their anxiety associated with the VIVA. Similarly, students reported improved confidence during their VIVA examination and a sense of being more relaxed or calm.

“They [the video examples] were reassuring and helped to calm you down leading up to the VIVA.”

“It [the preparation session] made us less anxious in the VIVA.”

“I was definitely more confident because I knew what the examiner was looking for.”
Sub-theme 3: Accessible

Students identified with the flexible nature of the VIVA preparation materials placed on the course website (including the videos) and suggested they were convenient and easily accessed.

“They [VIVA video examples] were easy to find and use.”

“It was good to be able to watch them [VIVA video examples] again whenever you wanted on the course website.”

“They [VIVA video examples] were easy to find and they played well.”

Sub-theme 4: Enjoyable

Students commented that the video-based VIVA preparation session was an enjoyable and worthwhile learning experience. Some associated positively with the competitive and interactive nature of the activity.

“It was good to be in such an interactive class.”

“It was a good competition.”

“Most people in the course really enjoyed the session.”

Sub-theme 5: Good timing
Students mentioned that the timing of the activity was helpful to them in preparing for their VIVA examination and further emphasised the importance of being able to access the materials at their convenience prior to their assessment.

“Especially being a couple of weeks before the VIVA, the timing was really good.”

“The timing [of the preparation activity] was perfect for the preparation.”

“It was good to be able to watch them [video examples] again just before the VIVA.”

Sub-theme 6: Predictable

One critical, albeit constructive theme that emerged from the focus group was related to the predictable nature of the VIVA example performances. Students felt that the provision of one good and one poor performance for each case scenario created polarised examples that made the overall quality of each performance too predictable. Nonetheless, it was clear that students perceived little ambiguity in the observed performances, which might be considered a benefit when teaching performance standards.

“It was a bit easy to predict which was good and bad. Maybe do bad first, then good.”

“They [video examples] were very clear cut – you knew which one was the bad one and which one was the good.”

Performance and agreement

VIVA performance for students in the current cohort (n = 62) was significantly better than for students in the previous cohort (n = 50) who were unsupported by the video
demonstrations (81.6 ± 8.7 vs. 78.1 ± 9.0, \( p = 0.01 \)). Student awarded marks were significantly lower than those awarded by the panel of examiners for both good (90.4 ± 5.5 vs. 94.0, \( p < 0.01 \)) and poor (38.2 ± 6.6 vs. 41.0, \( p < 0.01 \)) cardiorespiratory cases and the good neurological case (87.0 ± 6.3 vs. 90.0, \( p < 0.01 \)); however, there was no difference between students’ marks and panel marks for the poor neurological case (40.3 ± 6.8 vs. 41.0, \( p = 0.42 \)).

Discussion

The aim of our study was to determine student satisfaction of a video-based learning activity for improving preparedness for physiotherapy practical examinations and evaluate subsequent performance outcomes. Overall, we found that students were very supportive of the use of videos to support their learning, particularly in their application to clinical skills and practical examination preparation. Students found the new learning activity effective, suggesting it was enjoyable and improved their confidence in the practical examination. Thematic analysis of focus group responses reflected a very supportive student view of the new activity and the associated resources. Interestingly, we found that student marks awarded for three of the four VIVA video examples were significantly lower than those awarded by the panel of experienced examiners. Furthermore, we observed higher practical examination performance in the current student cohort compared with the previous cohort (unsupported by the video-based approach). That positive outcomes were observed not only for performance, but also engagement suggests that the activity had an impact on learning.

In preparing physiotherapy students for practical examinations, we followed the view of Sadler [12], taking an active approach to communicate assessment standards using multiple exemplars. In particular, we extended this approach by delivering such exemplars in the form of videos embedded in an interactive learning activity. We adopted this approach in
order to harness the very positive view of video resources exhibited by our student cohort. Certainly, student-focused approaches that incorporate exemplars and engagement with marking criteria tend to result in high quality learning outcomes, including a greater understanding of academic standards and marking criteria [14].

Recruitment of a recent-graduate physiotherapist into the role of the student in the video examples was intended to help students relate and identify with the performance. Thus, students were able to view and critically appraise the VIVAs performed by a ‘peer’, and in a sense, learn vicariously through her mistakes and achievements [15]. In this way, students might also experience the relevance of the activity in an intrinsic fashion with potential to deepen their understanding of the performance elements [16]. Furthermore, such episodically-rich examples may help students to develop semantic representations such that they might know rather than just remember [17]. In fact, reciprocal peer learning (or coaching) may be a more effective strategy than individual learning to teach clinical skills to physiotherapy students [18]; an observation supported by performance outcomes in our study.

Content analysis of focus group themes reflected a strong supportive student opinion of our method. Improved understanding and familiarity with the assessment objectives/standards and reduced performance anxiety emerged as the most prominent benefits of the initiative. Undoubtedly, understanding and performance anxiety are inversely related in this situation, an association reflected in the comments of focus group participants (e.g. “I was definitely more confident, because I knew what the examiner was looking for”). Certainly others have noted improved content understanding in student health professionals as a result of video-based teaching [19, 20], a benefit that can also extend to problem-solving in the clinical context [21, 22]. Other emergent themes related to the enjoyable nature of the activity, its timing, and the accessibility of associated web-based resources. In culminating our thematic findings, it appears that our intervention had the effect of motivating students
toward VIVAs as a method of assessment, which in itself is an important outcome with application to many disciplines.

In the current study, students awarded lower marks than the panel of examiners for three of the four VIVA examples. The discrepancy between student and faculty is not unexpected given the high order clinical/professional nature of the activities being rated. For example, peer assessments are shown to agree more strongly with faculty assessments when lower order content or processes, as opposed to high order professional practice processes [23]. That students were consistently more critical than the panel in awarding marks may indicate a tendency to polarise their judgement toward either ‘very good’ or ‘very bad’, given a lack of experience in observing clinical performances; a tendency that may be remedied with engagement in further clinically-based video examples and warrants further investigation. Despite feedback relating to the predictability of performances in the presented cases being considered criticisms, that performance levels were clearly identified shows a lack of ambiguity in students’ perceived levels of performance and suggests a level of mastery in this domain.

Students in the current study exhibited greater practical examination marks than students in the previous cohort who were unsupported by the video-based preparation. Our findings, however, are in contrast with those of Kelly and colleagues [2], who found no improvement in clinical performance of nursing students despite observing very positive student satisfaction of the method. The authors suggest that the method should complement rather than replace traditional teaching methods. Conversely, Thoirs and Coffee [24] found that the ability to identify anatomical structures of the ankle was improved following a DVD-based learning activity for training medical sonography students.
The timing of our activity and the space created for reflection appears to be an important facilitatory strategy for learning. Discordance between self-perception and feedback is demonstrated to provoke reflective behaviour [25]. Our learning activity was observed to produce a discrepancy in student-panel marks and discussion around ‘error-checking’ was an overt inclusion. Thus, it may be important to provide sufficient time between the activity and the assessment to allow for cycles of reflection.

Several limitations warrant acknowledgement. Firstly, in retrospect, we recognise that our surveys were constructed with language that might be considered leading (i.e. with positive bias) and thus, more conservative wording might have elicited less striking results. Secondly, VIVA performance measures were not tested against a control group, but rather compared with a previous student cohort. Despite our efforts to replicate all other aspects of VIVA preparation for the current cohort (i.e. same assessment, number of practical classes, amount of practice time), direct comparison with the previous year remains limited by other factors that are difficult to control (e.g. staff encouragement and timetabling). Finally, despite the use of an independent facilitator for focus groups, no post-analysis auditing was undertaken of our thematic analysis in order to confirm dependability.

Conclusion

This study demonstrates that a video-based learning activity for preparing physiotherapy students for practical examinations is an effective and feasible approach. Such an active and student-focused approach to assessment preparation appears to reduce student performance anxiety in examinations and may result in performance benefits. Furthermore, our approach could be easily adopted by other educators across a range of settings and professions.
In applying this approach, we make the following recommendations to others: 1) video examples be presented in a teacher-facilitated environment (as opposed to independent viewing); 2) a range of performances be presented; 3) open discussion of performance standards and improvement strategies be included; and 4) preparation workshops take place early enough in the semester to allow adequate time for students to reflect.

Acknowledgements:

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Ethical approval

Ethical approval to conduct the study was obtained from the Human Research Ethics Committee (Approval number: PES/17/11/HREC).

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Conflict of interest:

Authors declare there are no conflicts of interest.
References


Table 1: Responses to student survey of attitudes toward the use of video resources to support learning (n = 60).

<table>
<thead>
<tr>
<th>Survey Questions</th>
<th>Response (%)</th>
<th>Median</th>
<th>Range</th>
<th>Positive (%)</th>
<th>Neutral (%)</th>
<th>Negative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Video resources are effective to support my learning in physiotherapy</td>
<td>96</td>
<td>4</td>
<td>3–5</td>
<td>98</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2. Video resources have been used extensively to support learning in my program so far</td>
<td>96</td>
<td>4</td>
<td>2–5</td>
<td>56</td>
<td>37</td>
<td>7</td>
</tr>
<tr>
<td>3. Video demonstrations of VIVA examinations would be beneficial to support my VIVA preparation</td>
<td>96</td>
<td>5</td>
<td>3–5</td>
<td>95</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>4. Rating video demonstrations of student VIVA examinations with the marking criteria will be beneficial to my VIVA preparation</td>
<td>96</td>
<td>4</td>
<td>2–5</td>
<td>83</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>5. Video examples of VIVAs placed on Learning@Griffith will be beneficial to my learning in this course</td>
<td>96</td>
<td>5</td>
<td>3–5</td>
<td>98</td>
<td>2</td>
<td>0</td>
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</table>
**Table 2:** Responses to student survey of satisfaction with the new video-based teaching and learning activity for VIVA preparation (n = 55).

<table>
<thead>
<tr>
<th>Survey Questions</th>
<th>Response (%)</th>
<th>Median</th>
<th>Range</th>
<th>Positive (%)</th>
<th>Neutral (%)</th>
<th>Negative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overall, the video resources used in this course were effective to support my learning</td>
<td>89</td>
<td>5</td>
<td>3 – 5</td>
<td>98</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2. Rating video demonstrations of VIVA examinations was an effective learning and teaching activity</td>
<td>89</td>
<td>5</td>
<td>3 – 5</td>
<td>96</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>3. Video demonstrations of VIVA examinations were beneficial to support my VIVA preparation</td>
<td>89</td>
<td>5</td>
<td>3 – 5</td>
<td>98</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>4. Rating video demonstrations of student VIVA examinations improved my familiarity with the criteria and VIVA objectives</td>
<td>89</td>
<td>5</td>
<td>3 – 5</td>
<td>93</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>5. Use of the video demonstrations of VIVA examinations improved my confidence in the VIVA</td>
<td>89</td>
<td>4</td>
<td>3 – 5</td>
<td>95</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>6. The video examples on Learning@griffith were easy to find and operate</td>
<td>89</td>
<td>4</td>
<td>1 – 5</td>
<td>73</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>7. I enjoyed the VIVA preparation session</td>
<td>89</td>
<td>4</td>
<td>3 – 5</td>
<td>93</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>8. Video demonstrations of VIVA examinations should be used in future courses</td>
<td>89</td>
<td>5</td>
<td>3 – 5</td>
<td>98</td>
<td>2</td>
<td>0</td>
</tr>
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</table>
Table 3: Content analysis of identified themes from focus group responses.

<table>
<thead>
<tr>
<th>Theme/Sub-theme</th>
<th>Count</th>
<th>Percent Text Coverage Represented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supportive</td>
<td>77</td>
<td>67.0</td>
</tr>
<tr>
<td>Accessible</td>
<td>8</td>
<td>4.0</td>
</tr>
<tr>
<td><em>Improved understanding</em></td>
<td>22</td>
<td>15.9</td>
</tr>
<tr>
<td>Reduced anxiety</td>
<td>18</td>
<td>9.2</td>
</tr>
<tr>
<td>Enjoyable</td>
<td>11</td>
<td>3.9</td>
</tr>
<tr>
<td>Good timing</td>
<td>4</td>
<td>2.9</td>
</tr>
<tr>
<td>Criticisms</td>
<td>13</td>
<td>14.5</td>
</tr>
<tr>
<td><em>Predictable</em></td>
<td>8</td>
<td>7.0</td>
</tr>
</tbody>
</table>
Figure Legends

Figure 1. Survey of student attitudes toward the use of video resources to support their learning.

Responses made on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree):

1. Video resources are effective to support my learning in physiotherapy.
2. Video resources have been used extensively to support learning in my program so far.
3. Video demonstrations of VIVA examinations would be beneficial to support my VIVA preparation.
4. Rating video demonstrations of student VIVA examinations with the marking criteria will be beneficial to my VIVA preparation.
5. Video examples of VIVAs placed on Learning@Griffith will be beneficial to my learning in this course.

Figure 2. Survey of student satisfaction with the new video-based teaching and learning activity for VIVA preparation.

Responses made on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree):

1. Overall, the video resources used in this course were effective to support my learning.
2. Rating video demonstrations of VIVA examinations was an effective learning and teaching activity.
3. Video demonstrations of VIVA examinations were beneficial to support my VIVA preparation.
4. Rating video demonstrations of student VIVA examinations improved my familiarity with the criteria and VIVA objectives.
5. Use of the video demonstrations of VIVA examinations improved my confidence in the VIVA.
6. The video examples on Learning@griffith were easy to find and operate.
7. I enjoyed the VIVA preparation session.
8. Video demonstrations of VIVA examinations should be used in future courses.
**Figure 3.** Focus group structured questions.

1. Were the video resources used in this course helpful to your learning?
2. Was the teaching and learning activity of rating viva examinations effective?
3. Were the videos of viva examinations easy to find and operate?
4. Did the use of the videos improve your familiarity with the examination criteria?
5. Did the use of the videos improve your confidence in undertaking the viva?
6. Do you think the use of the videos helped to reduce your anxiety in the viva?

**Figure 4.** Thematic map including sub-themes.