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Digital Workbooks in Flipped Nutrition Education: Student Perspectives'

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Abstract: Nutrition and dietetic (N&D) education is traditionally taught didactically; however, the flipped classroom approach (FCA) is an emerging pedagogical approach in this discipline. Technological tools providing cognitive support enhance learning, particularly when students are engaged. In N&D education, students have reported the FCA as engaging; however, evidence for how best to integrate technologies into the FCA is limited. The aim of this research is to explore undergraduate nutrition and dietetic students' self-reported perceptions of the use of a digital workbook in nutrition courses designed and delivered using an FCA. A cross-sectional self-administered online survey was utilised to investigate Australian undergraduate student (N = 39) satisfaction, frequency of use, engagement with, and usefulness of a digital workbook. Most students (87%) were satisfied/very satisfied with the digital workbook as a tool for learning, applying and consolidating/revising course content. Most students (95%) agreed the digital workbook was engaging, providing comments related to workbook design, encouraged participation and novelty. Most useful aspects reported were workbook structure, development of a learning artefact, self-directed aspects and convenience, whereas, least useful aspects included technological issues. The use of a digital workbook in N&D education was well received and is an innovative approach to delivering courses taught with an FCA.

Keywords: flipped classroom; nutrition education; dietetics; blended learning

1. Introduction

Traditionally, a didactic pedagogical approach is used in nutrition and dietetic (N&D) education [1]. However, students in this discipline generally have diverse learning styles [2,3], suggesting this traditional approach may not be as effective for knowledge development. Further, in health care disciplines generally, content overload coupled with learners' expectation for variety and engagement is driving change in the development and delivery of higher education [4].

Within higher education, blended learning approaches, that refers to the mix of face-to-face (F2F) and online learning, provide an opportunity for educators to create learning environments that extend beyond the traditional classroom [5], providing greater flexibility for students. Students can complete online activities when it suits them, an important consideration because students are typically balancing formal education with other competing commitments [5]. In the flipped classroom approach (FCA), asynchronous pre- and post-class activities are combined with synchronous F2F activities [6,7]. Responsibility for learning is shifted to students as they are required to complete self-paced learning prior to attending class where facilitated collaborative activities build on pre-class work to actively construct knowledge [8]. However, it has been reported students find flipped classrooms to be time consuming, perceive an increase in workload and find adoption of the approach problematic [9].

To facilitate the FCA, various technologies, including pre-recorded lectures and automated study guides are available to support course delivery [10]. Technological tools that provide cognitive support enhance learning, particularly when students are engaged [11]. In N&D education, students have reported the FCA as engaging [12]; however, evidence for how best to integrate technologies into the FCA is limited. This study investigated the use of an online personal learning and assessment system PebblePad (PebblePad v5, Pebble Learning Ltd, Telford, UK, 2016), embedded as a digital workbook, as a supporting technological tool in three nutrition courses taught with an FCA. PebblePad, with a series of pre-designed templates is widely used in Higher Education as an e-portfolio tool [13]; however, the functionality of the platform allows for users (educators and students) to create structured interactive workbooks using self-developed or existing customized templates to record learning experiences. The aim of this investigation is to explore students' perceptions of the use of the digital workbook to develop and evidence knowledge and skills in nutrition courses designed and delivered with an FCA.

2. Materials and Methods

To investigate students' perceptions of the digital workbook, a cross-sectional self-administered questionnaire was distributed to all students enrolled in the three flipped nutrition courses. Ethical approval was obtained through the authors' institution (retracted for peer-review).

In 2019, three 13-week undergraduate nutrition courses across years one (introductory level) to three (graduate level) in the N&D discipline at a regional Australian University were taught using the FCA with a supporting PebblePad digital workbook. This approach was used in response to the institutional blended learning strategy, institutional principles of curriculum design and in recognition of our diverse student cohort, of whom many are mature-aged, female, travel from outside the region and are first in family to study at University. The process of workbook design provided an opportunity to strengthen the constructive alignment between weekly learning activities and assessment to the course outcomes. Students were provided with a free password-protected PebblePad account via the University.

Courses were developed with three learning phases: (i) prepare (asynchronous self-directed pre-class activities); (ii) participate (synchronous directed in-class activities); and (iii) recap (asynchronous post-class self-directed activities). Phases were aligned with levels of Blooms Taxonomy [14]; remember and understand for the prepare phase, apply and analyse for the participate phase and evaluate and create for the recap phase. Although the courses were nutrition-related, they were diverse in content. The introductory-level course introduced students to the nutrition science profession (what a nutritionist does, scope of practice, the food system); the developing-level course covered the paddock to plate journey of food and associated food science (biological, chemical, and physical changes resulting from food production and processing and resulting nutritional and sensory implications), and the graduate-level course covered the interaction between food and the consumer (food and culture, global nutrition issues and product development). Students enrolled in the Bachelor of Nutrition are required to complete all three courses, while Bachelor of Dietetics students are required to complete the developing level course only. Students from other programs could enroll in the developing level course if they had completed the pre-requisite of chemistry.

The digital workbook template consisted of an introduction page (welcome and overview of the workbook) and 13 weekly page headers (Figure 1). Each weekly page header had a drop-down menu where students could access the following five pages: (i) weekly overview; (ii) prepare: pre-class activities; (iii) participate: class/workshop activities; (iv) recap: post-class activities; and (v) extra notes (an area where students can attach and store extra images/documents) (Figures 2 and 3).

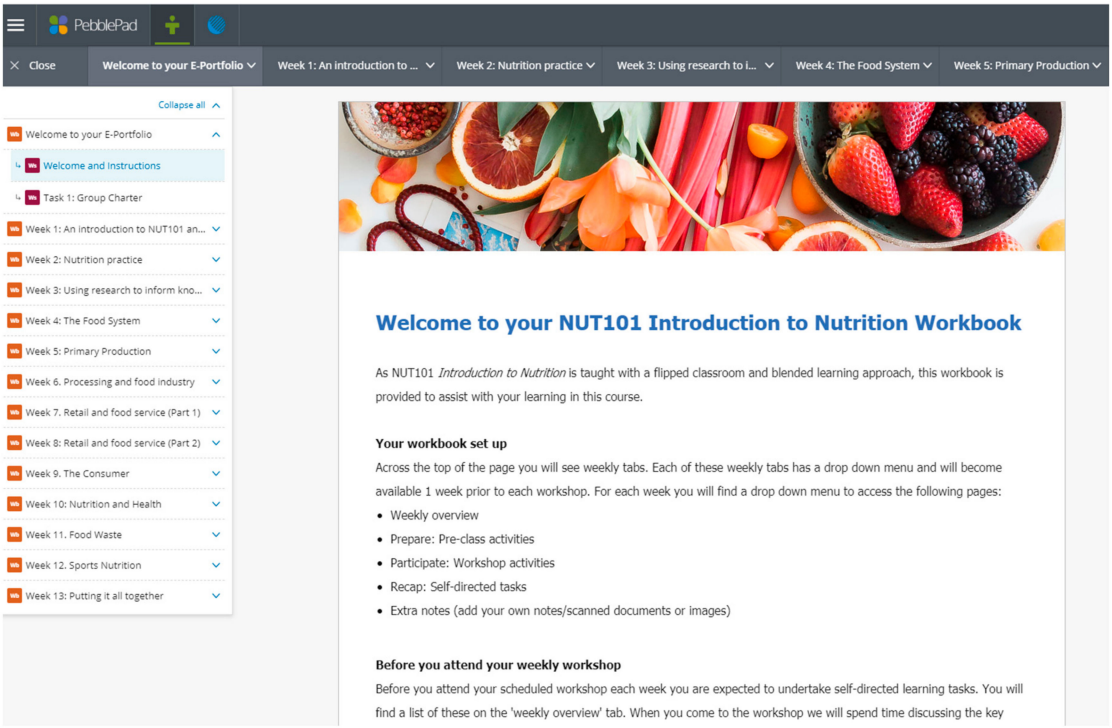

Figure 1. Overall structure of the digital workbook (course name redacted for peer review).

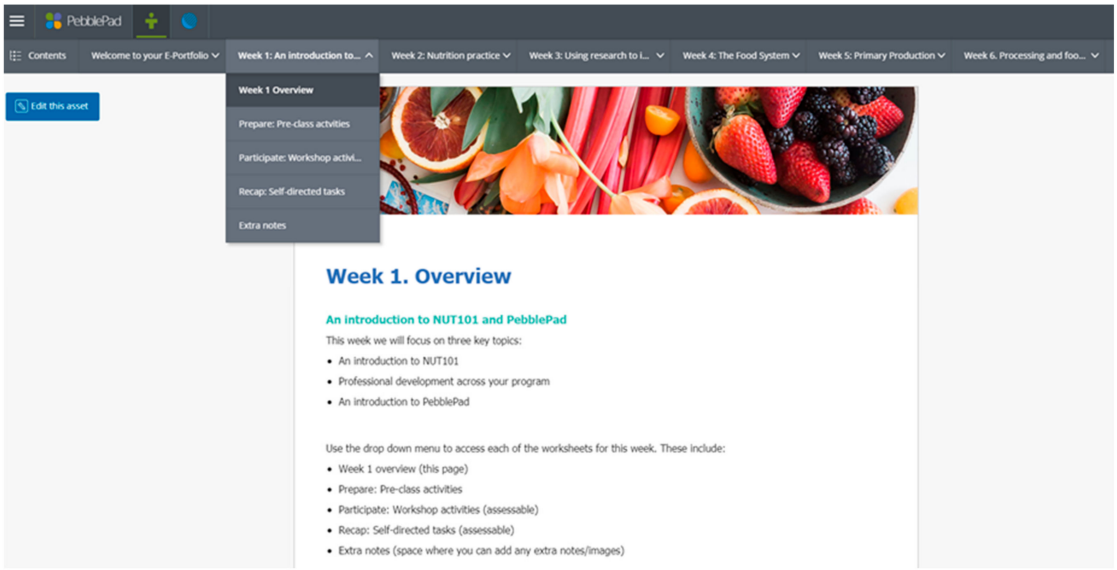

Figure 2. Example of a weekly overview page with drop-down menu.

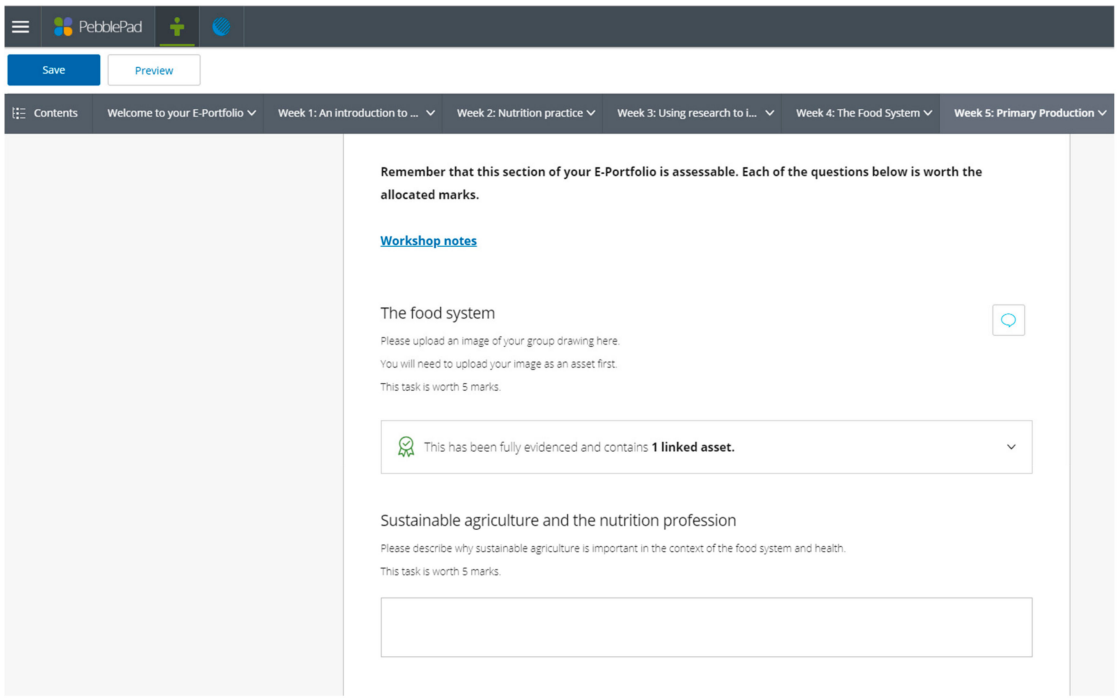

Figure 3. Example of participate questions in a digital workbook.

In class, students were provided with instruction on how to access and use the digital workbook. Generic, application-specific help was also available within the PebblePad program. Completion of weekly tasks was incorporated into the assessment of each course, with students expected to complete each week's activities by the required due date with one week from each submission chosen randomly for marking. Assessable sections included the participate and recap sections for the introductory- and developing-level courses and the prepare, participate, and recap sections for the graduate-level course.

2.1. Data Collection

A 20-question online questionnaire deployed with SurveyMonkey was available for four weeks from week 12 of the semester. The questionnaire was peer-reviewed for face validity to ensure that the questions were relevant and appropriate. Students enrolled in the three courses (n = 162) were invited to participate in the study in class and through questionnaire links provided via email. Participation was voluntary, and students were provided with a Research Project Information Sheet describing the collection, analysis and presentation of data. No incentive was provided for participation. The questionnaire took approximately ten minutes to complete and consent was implied through completion.

Four demographic questions (sex, age, program of enrolment, full- or part-time enrolment status) were included. Two questions asked for previous experience using PebblePad and enrolment in a flipped class. Self-reported confidence in ability to use new technology was measured on a 5-point scale of not confident at all to extremely confident. Overall satisfaction of using the digital workbook was measured on a 5-point scale of very satisfied to very dissatisfied. Students were asked to report frequency of access to the digital workbook and the type of device used when accessing the digital workbook (mobile phone, tablet or iPad, laptop, desktop computer). Frequency of use of the digital workbook to learn content related to the course, apply content related to the course, consolidate and revise content related to the course, and for storing important documents and learning materials for the course was measured on a 6-point scale from several times a day to never. Students were asked to report if they found the workbook engaging and to elaborate with an open-ended response on why or why not they found the workbook engaging. Open-ended responses for the most useful and

least useful aspects of the digital workbook were recorded. Students were also asked to report if they intended to use the digital workbook to demonstrate or evidence their knowledge of the content covered in the course in the future (yes, no, I am not sure).

2.2. Data Analysis

Quantitative data were analysed descriptively using SPSS (SPSS version 24, SPSS Inc., Chicago, IL, 2016). Data are presented as mean, range and proportion. Responses to the frequency of access and use are summarised with percentages for each level of the 6-point Likert scale. Responses to questions for overall satisfaction and self-reported confidence in using new technology are summarised with percentages for each level of the 5-point Likert scale. Textual data from open-ended questions were analysed using conventional content analysis [15]. The authors independently read and re-read the entire data set for familiarization and independently applied initial descriptive codes to written responses. Codes defined during data analysis were refined through comparison and discussion [16]. The initial coding scheme was then applied through a final round of independent coding to produce key categories.

3. Results

3.1. Participant Characteristics

Thirty-nine students completed the survey (24% response rate). The mean age was 31 years (range 18–64 years), and more females (n = 36, 95%) than males (n = 2, 5%) participated. More students were enrolled in the Bachelor of Nutrition (n = 23, 59%) compared to the Bachelor of Dietetics (n = 16, 41%). Most students reported full-time enrolment status (n = 30, 81%), while 19% (n = 7) reported part-time enrolment. Two-thirds of the participants (n = 25, 66%), had previously used PebblePad, and three-quarters (n = 29, 76%) reported previous experience with the FCA.

A laptop was used by most students to access the digital workbook (n = 32, 82%). Only one student reported using a mobile phone, two used a desktop computer and four a tablet or iPad (10%). Most participants reported being somewhat confident (n = 7, 18%), quite confident (n = 21, 54%), or extremely confident (n = 9, 23%) in their ability to use new technology. Two participants (5%) reported that they were not confident at all in their ability to use new technology.

3.2. Satisfaction with The Digital Workbook

Most students were satisfied with their experience of using the digital workbook, with 56% (n = 22) and 31% (n = 12) very satisfied or satisfied, respectively. Two students (5%) reported neither satisfied nor satisfied, and three (n = 8%) as dissatisfied.

3.3. Frequency of Digital Workbook Use

Most students reported accessing their workbook several times a week during the semester (n = 23, 59%), with six participants (n = 15%) reporting about once a day, two (5%) several times a day and seven students (18%) reporting use about once a week. Only one student reported using the workbook less than once a week. Students reported using the digital workbooks more often for learning, applying and consolidating/revising content related to the course, with less frequent use for storing important documents and learning materials (Figure 4).

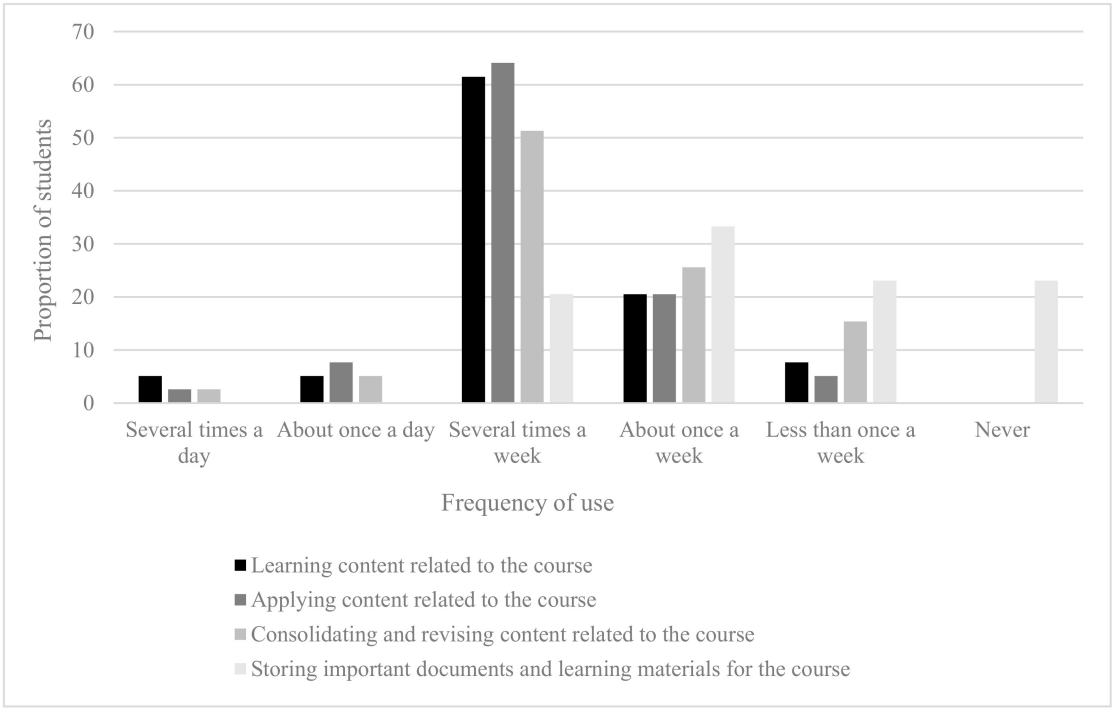

Figure 4. Proportion and frequency of student use of the digital workbook for learning, applying, consolidating/revising and storing documents/materials.

3.4. Digital Workbook Engagement

The majority (95%, n = 37) of students reported that the digital workbook was engaging, with 34 providing comments to support this. Content analysis identified three key categories of: (i) workbook design; (ii) encouraged participation; and (iii) novelty. Overall, students reported the workbook design as the most engaging aspect. For example, '*all content was easy to access, well-structured/laid out*' (Participant 20); '*the layout was easy to navigate with week by week sections*' (Participant 10). Students indicated the digital workbook encouraged participation in learning activities, particularly for revision and consolidation of knowledge. Additionally, students felt that the workbook held them accountable for completing activities and tracking progress. As noted by one student, '*the workbook encouraged learning and revision. To truly understand the content, I found I had to engage with PebblePad which was a good thing for me*' (Participant 15). Novelty was also reported as an engaging aspect, '*it was engaging to use a different type of learning compared to standard reading and writing off Blackboard*' (Participant 29). Two students felt the workbook was not engaging. One did not appreciate the amount of work required to complete the workbook and the lack of feedback, the other did not like PebblePad as it was '*clunky and time-consuming and does not appeal to my learning style*' (Participant 52).

3.5. Usefulness of the Digital Workbook

Comments for the most useful aspects were provided by 37 students. Four key categories emerged through content analysis: (i) workbook structure; (ii) development of a learning artefact; (iii) self-directed aspects; and (iv) convenience. Students found the ease of use, organisation of content, including having this all in one place, as the most useful aspect. As noted by one student '*that the content from the entire course is all stored in one place, it is easy to look back on past week's work*' (Participant 13). The development of a learning artefact that supported revision; '*it became a valuable reservoir of information/facts leading up to the exam*' (Participant 2). Self-directed aspects included completing tasks independently and at a time that suited students were considered useful, for example '*It was online and easily* accessible' (Participant 48); '*being able to watch or read the content at my leisure then being able to revise at my leisure*' (Participant 49).

Least useful aspects were reported by 31 students and most comments related to technology such as issues with uploading and submitting work. Six students highlighted lack of feedback as a least useful aspect, for example '*we didn't really get any useful feedback*' (participant 41); '*I wish we could have all gone through the questions together the following week in class to see how we went and provide answers if wrong*' (participant 16). One student noted they preferred paper workbooks.

Half of the students (n = 20, 51%) reported that they intend to use the digital workbook to demonstrate/evidence knowledge of the content covered in the course, three students (8%) reported they did not intend to, while 41% (n = 16) reported 'I am not sure'.

4. Discussion

This study describes N&D students' perspectives of a digital workbook used in an FCA. While there is limited literature that reports N&D student engagement with the FCA [12,17], there is no research investigating the use and perceptions of digital workbooks in nutrition education using this approach. The FCA differs from traditional didactic and hybrid teaching in that students are required to independently complete self-directed asynchronous pre- and post-class activities, which requires students to assume more responsibility for their learning [18]. We created our digital workbooks to help maximize student learning in nutrition courses taught with the FCA. The purpose of our digital workbooks was to support students and promote increased ownership by signposting and scaffolding learning experiences to achieve learning outcomes. Our results show that N&D students appreciated clearly designed workbooks that encouraged active participation in course activities and demonstrates digital workbooks can be a useful tool for nutrition education taught using an FCA. Despite some issues relating to technological aspects and feedback, the digital workbook was perceived to be a very useful tool for both asynchronous and synchronous aspects of the FCA. Students frequently used the digital workbook for learning, applying, consolidating and revising course content. Students appreciated the convenience of being able to work at their own pace and at a time that suits them.

Constructive alignment relates to the construction of knowledge through activities and the alignment of teaching and assessment to intended course learning outcomes [19], and is an important element of course design. The digital workbook was purposefully designed to maximize alignment between these aspects and could explain the number of comments about workbook organisation from our cohort. Most students appreciated the structure of the digital workbook noting the organisation of the workbook made it easy to navigate and stay on task throughout the course. While we could not identify associations between participant characteristics and those who found the structure useful due to our small sample size, it would of interest to be able to explore why structure and organisation were identified as being useful and engaging.

One of the key concerns reported by students using the digital workbook was technological issues, despite the majority rating their confidence in use of new technology highly. Although we attempted to mitigate technological issues with instructions and in-class support, it is clearly an aspect that requires attention. It is generally agreed in higher education that technology should not overshadow learning and teaching fundamentals [20]. While the use of technology can improve the learning experience for students, it is important to ensure that pedagogy is at the forefront of course design, and not at the expense of technology use. There can be a tension between the use of technology and the student learning experience if technology issues are not addressed, leading to decreased student engagement and motivation and increased stress [21,22]. It is important for staff and the institution to have the skills and services to support students as they are simultaneously required to learn a new platform in addition to meeting course requirements [21,22]. Further research could investigate student preferences for support when implementing a digital workbook.

Students highlighted a lack of feedback on completed items in the digital workbook as an issue; however, this is largely due to the integration of assessment in the workbooks, making these comments a reflection of the course structure rather than the technology. Feedback is an essential aspect of learning as it assists the learner to evaluate their performance and may increase engagement [23]. Feedback should

be timely and useful, particularly when related to assessment [24]. Recent research has highlighted that feedback is a core element of technology-enabled active learning and technology can easily provide instant feedback [23]. However, in the courses evaluated in this study, feedback on completed activities was not readily available to students as not all weeks were marked. Future iterations of the courses should consider this and incorporate the provision of weekly feedback, if feasible.

The digital workbook was viewed as a useful tool for the development of a learning artefact, although most students were unsure of whether they would use it to evidence their learning in the future. We found that students reported using the workbook more frequently for learning and applying content related to the course, which is not surprising given the structure of the FCA, whereby there is a focus on completing activities pre, during and post designated class times. It is possible that given the digital workbook is a new tool, students do not see the possible value of the digital workbook in evidencing learning and competency for further study or employment opportunities. This could be alleviated by educators communicating and emphasizing the purpose of the digital workbook at the onset of the course [21,22]. The integration of digital workbooks into a programmatic e-portfolio approach may also assist students to view the course as one component of a professional portfolio.

There were several comments highlighting the convenience of the workbook, which may reflect our student cohort and could explain the frequency of digital workbook use. While we were not able to investigate associations between participant characteristics and patterns of digital workbook use due to our small sample size, it would be of interest to understand how the workbook enables convenience given our general cohort anecdotally report balancing study, employment and carer roles.

4.1. Limitations

We had a small, homogenous sample, which limits the generalizability of our findings. Associations between participant characteristics and satisfaction, frequency of use, engagement and usefulness of the digital workbook were not able to be investigated as the small sample size limited the analysis. Future research with a larger and more diverse sample size is warranted to understand preference for and use of a digital workbook in the FCA. Other forms of data collection, for example, qualitative focus groups, may enhance response rates and explore student preferences in more detail in future studies. As the three courses used in this study were taught by two educators (one taught the introductory and graduate course, one taught the developing-level course), it is possible that students experienced different teaching experiences, potentially influencing perceptions of digital workbook use. The study used self-report responses and we acknowledge that students may have interpreted qualitative items differently.

4.2. Implications for Research and Practice

These findings are of use to educators considering the design and deployment of courses taught with the FCA. A well-designed digital workbook can assist students completing a course taught with an FCA. Educators need to carefully consider how and when feedback is provided to students to ensure students see the value in the digital workbook. It is also important for educators to clearly outline the purpose of the digital workbook and to have support mechanisms in place to assist students when required. Further investigation of student perceptions of the digital workbook, particularly with a larger and more diverse cohort, and whether the use of a digital workbook assists learning outcomes in the context of the FCA is warranted.

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