

## Article

# Being Innovative in Running an Online Food Research Project in Consumer Sciences during the COVID-19 Pandemic

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**Abstract:** The COVID-19 pandemic challenged many higher education institutions to accelerate the implementation of teaching and learning through an online mode of delivery. The unpredicted shift to online learning created unprecedented challenges for Consumer Sciences students which usually perform laboratory-oriented research projects; however, any employable skills acquired during undergraduate studies should be transferable to new circumstances within different working contexts. The aim of this article is to provide educators with a basic 10-step approach to complete an online food research project and to consider students' engagement, reflections and experiences. The article consists of three parts. The first part provides ten research steps to complete an online food research project, followed by students' reflections of the research project. The second part presents the results on students' online engagement with an e-learning platform. The third part presents the results of students' experiences from the university's student survey of the lectured module. Recommendations made from students' reflections stimulated their higher-order thinking as they comprehended the value and importance of research, project based-learning and critical evaluation for future improvement. Educators are responsible for helping students discover their own support networks, to provide opportunities and events to share their values and work, and to motivate and encourage student engagement and reflective discussions in the online environment to stimulate higher-order thinking and enhance students' professional and sustainable development.

**Keywords:** students; research project; consumer sciences; online learning; engagement; reflections; experiences



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## 1. Introduction

The COVID-19 pandemic [1] has dramatically stirred the university education system, which transitioned teaching and learning to an online approach and resulted in the cancellation of contact sessions and visits to the industry [2,3]. The pandemic forced universities across the world to close campuses. Furthermore, educators in higher education were compelled to rethink the value of online learning with regards to Information and Communication Technologies (ICT). The surfacing of software technologies endows the usage of multimedia programs and packages [4] for educators and provides access to the learning content conveniently at any time and place [5].

During March 2020, as in many other countries, South Africa, transitioned into remote and online learning modes, impelled to save the academic year. Education in emergency situations, such as the COVID-19 pandemic, usually relies on the use of ICT. As a result, the South African government collaborated with non-governmental entities and mobile networks to plan for education continuity via several mobile, social media and online platforms. Nonetheless, regardless of these endeavors and some tertiary institutions' use of e-learning as a supplementary method, South Africa's higher education sector was inadequately prepared for the full online experience [6]. The lack of technological tools and educational resources created challenges for most of the countries' education system for high-quality continuous education, and the creation of a sustainable environment [7].

In tertiary educational curriculums such as Consumer Sciences, practical classes require interactive moments to solve real life scenarios in the future. This creates additional challenges in creating sustainable solutions because tertiary institutions lack the technological resources that could help educators provide effective practical lectures. Owing to the use of ICT, e-learning training amidst the pandemic, has been updated and implemented training opportunities for professionals in the social and healthcare disciplines. This type of training is very useful for consumer sciences graduates, who also have academic responsibilities and should complete work hours for Work-Integrated Learning (WIL), as it allows them to maintain a work-study-life balance [8]. A wide range of ICT tools such as web-based learning, videoconferencing, pre-recorded videos, social media and live streaming applications are being implemented to ensure the continuity of teaching and learning during the COVID-19 pandemic [9].

Currently the Sustainable Development Goal (SDG) 4 lacks indicators for measuring the use and integration of ICT in teaching processes and the level of digital competence for educators. According to the Teaching and Learning International Survey (TALIS) of the OECD in 2019, a high need for training from educators for the use of ICT was reported as 60% reported a higher need for development in this area [10]. Therefore, a project-based step approach could stimulate educators' ideas to ensure that learning ICT and higher-order thinking skills, are reached successfully amidst a global pandemic.

Consumer sciences focus on the well-being of consumers and their interaction with communities and the environment. The role of the consumer scientist is to explore consumers' behavior and address their basic needs that consist of food, housing and clothing [11]. Third year undergraduate students on a National Qualifications Framework (NQF) level 7 [12], registered for a four-year Consumer Sciences in Food Product Management degree at the North-West University, Potchefstroom, South Africa, should complete a food project that is part of a 12-credit (i.e., requires 120 h to master) Food Innovations and Trends module [13]. On completion of this food module, students should have demonstrated the ability to bring together their undergraduate and newly acquired knowledge by completing an online food research project. The student should have been able to:

1. conduct consumer research by practically applying a coherent and critical comprehension of the principles of food innovation and trends in the execution of a structured food project;
2. analyse relevant literature critically and apply it to the given problem of the food project;
3. compile a project report and give a summary of the findings in the form of a presentation; and
4. conduct an individual critical evaluation of the completed project.

Project learning could motivate students to work in groups on real-world problems to stimulate the attainment of critical- and higher-order thinking skills [14]. Undergraduate research projects in consumer sciences usually include laboratory work under the supervision of the educator. The sudden transition to synchronized online learning created new challenges but also opportunities to find innovative alternatives for the students to complete their research project during the COVID-19 pandemic. It is therefore imperative that the skills university students learn are versatile and transmittable to new circumstances [15], as we are experiencing with the pandemic.

Consumer sciences are considered a comprehensive discipline as students should develop employable skills to prosper within different working environments. A study on South African consumer sciences students' employability skills revealed that employers require specific employability skills such as ICT, English proficiency, interpersonal, leadership, group work, problem solving, time management, adaptability, organization, and creativity [16]. This article will not elaborate on employability skills but argues that within educators' current context of online teaching, ICT skills are one of the most required skills for undergraduate students to succeed professionally. ICT skills deal with one's knowledge and ability to use technology (e.g., send and receive e-mails) or computer software such as using MS-Office [17]. Employers require graduates to have proficient computer skills and

regards technology as an essential basic skill [18]. Results confirmed that more than 57% of consumer sciences students in South Africa indicated that completing assignments in group format is the most effective way to teach ICT skills [16]. Educators specified that the assessment of students' use of ICT skills is irrelevant, as it is more valuable to assess the end product of a projects' success where the use of ICT skills are essential. Therefore, students should learn to perform information sifting and how to communicate the required information effectively [19]. From a teaching perspective, students must be provided with relevant research topics [20] that will promote writing skills to improve their ICT skills.

Therefore, the aim of this article is to provide educators with ten basic steps to complete an online food research project and to consider students' reflections, engagement and experiences on completing the food module. The knowledge gained could support educators on how to run, administer and assess a consumer-based research project to improve the quality of education and ensure that students are equipped with the necessary employability skills, competencies and experience to enhance their future career prospects. Educators should develop tasks that require skills of higher order comprehension. An educators' level of knowledge and competency are imperative in the deployment of higher-order thinking skills to enhance students' learning outcomes [21].

Thus, the article consists of three parts, each of which reflects on the concept of innovation and creativity in the tertiary educational setting during the COVID-19 pandemic (Figure 1). In the first part, a basic 10-step approach to complete an online food research project is provided, followed by the results of students' reflections made from the critical evaluation of the online food project. The second part presents the results on students' online engagement with the e-learning platform. The third part presents the results of students' experiences of the university's student survey.

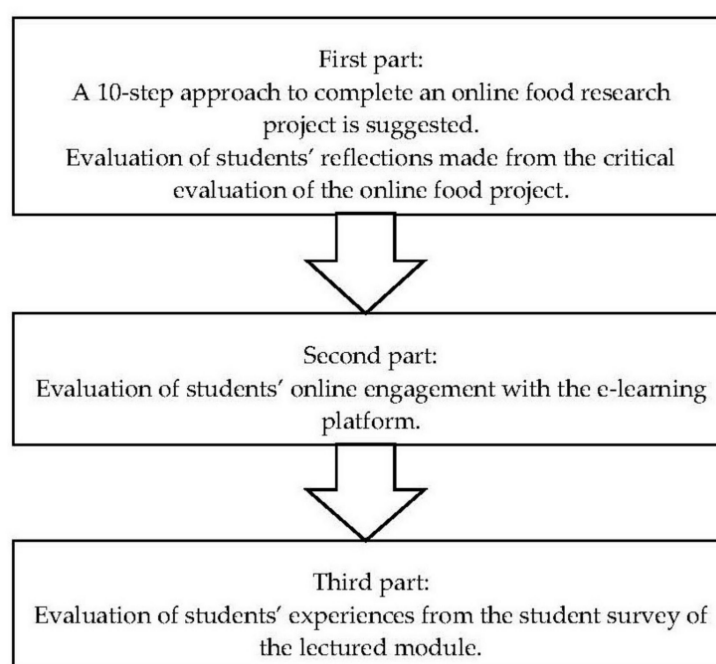
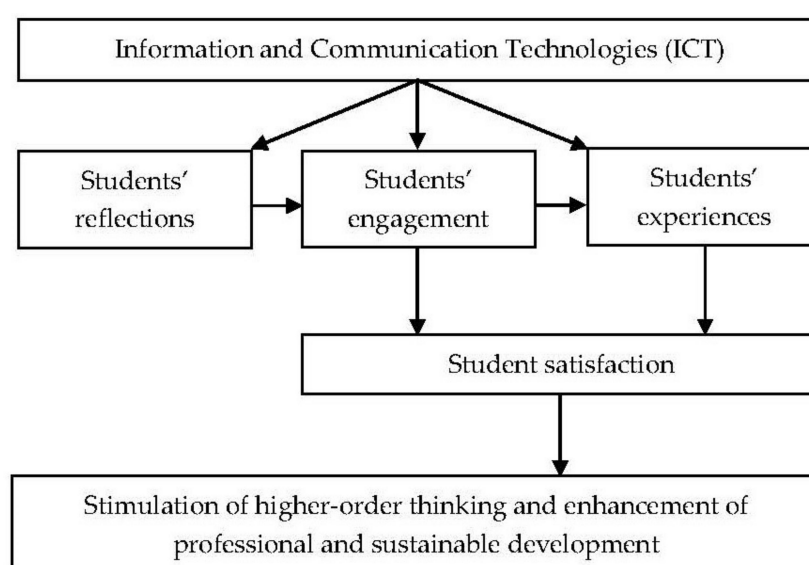


Figure 1. Research algorithm.

## 2. Related Literature

The framework in Figure 2 illustrates the role of ICT, students' reflections, engagement and experiences on the stimulation of higher order thinking and the enhancement of students' professional and sustainable development. In congruence with the underlying aim of this article, the related literature intends to elaborate on ICT and education and students' reflections, engagement, and experiences.



**Figure 2.** The role of ICT, students' reflections, -engagement and -experiences.

### 2.1. ICT and Education

Educational technology forms a fundamental part of today's tertiary learning environment. Educators are constantly exploring new technological approaches to facilitate learning, enhance the quality of education and to increase student satisfaction [22]. ICT accentuates the integration of computers, software and audiovisual systems. In the educational context, ICT focus on the use of audiovisual, computer and technological based resources to facilitate communication and for information processing [23], especially to address educational problems as experienced during the COVID-19 pandemic. The use of ICT can give students more access to a wider range of information sources for learning. It has been associated with improved academic performance, a rise in collaboration between students and tertiary student engagement [22]. Furthermore, ICT can assist with better monitoring of student progress that could result in an increase in students' autonomy and flexibility and could improve their learning experiences. Introducing students to ICT—enhanced education to develop worldviews, attitudes and skills, makes a strong argument to promote sustainable growth and development in the educational context. For educators, ICT could make lectures more attractive and interactive [24].

The integration of ICT into the tertiary education sector resulted in the development of web-and Internet-based learning modes of delivery, such as e-learning and mobile-learning [25]. E-learning involves a diverse range of applications such as web-based training, computer-assisted learning, virtual classrooms and digital collaboration. E-learning is a popular means of ICT in the educational context as it creates a two-way communication platform between students and educators where educators provide a structured learning experience for students via timely feedback and social learning are strengthened with student-student discussion. Potential aspects such as miscommunication between students and educators, students' efficacy in using technology for learning and a lack of students' computer competencies can hinder the successful delivery of e-learning. Therefore, since e-learning is associated with technology and considered as communication tools for learning, their proficiency and effectiveness when applied as such technology, is of utmost importance [26].

Massive open online courses (MOOC) are regarded as one of the most rapid technological shifts in the tertiary education sector as it aims for open access via the web and unlimited participation [27]. MOOC can be characterized by their learning-oriented structure and usually involves different assessment types that verify students' skills and capabilities acquired [8]. In addition to traditional course materials (e.g., lecture notes, reading materials and assignments), MOOC often provide interactive chat or discussion

tools to support continuous interaction and communication among online learners and educators. After COVID-19, MOOC have been widely discussed in academic areas as an innovative tool for sustainable education. When measuring the quality of MOOC, it has to reveal students' individual needs and interests, with particular emphasis on the pedagogical features. As there are many types and providers of MOOC available to distribute knowledge and skills, it could be challenging to set general quality standards for MOOC. Therefore, MOOC should rather be seen as a means for discovery for learners, meaning that a process based approach rather than an outcome-based approach should be implemented [28].

Gamification is a conventional notion in technological systems that adopts a game mechanism to present positive performance outcomes and facilitate desired behaviors. The incorporation of gamification in MOOC could positively influence students' motivation if adequately designed and implemented. In order to maintain and increase students' interest and engagement, the gamified design of MOOC should include emotional incentives by giving students social interaction opportunities, entertaining functions and challenging cases [29].

The application of video games for educational purposes could strengthen decision-making-, knowledge-, and psychomotor skills and provides an opportunity for revision and instant feedback. Serious games, defined as educational games "...that do not have entertainment, enjoyment or fun as their primary purpose—they are a mental contest, played with a computer in accordance with specific rules, which uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives". The dynamic characteristics of serious games creates an interactive source of learning that drive students to expand their knowledge and improve their thinking skills in an informal manner. For example, skills such as communication, creativity and problem solving are developed when a game such as CMX, a Massively Multiplayer Online Role-Playing Game (MMORPG) is incorporated [30]. A MMORPG can promote learning by enabling students to plan strategically and think critically when integrated in the higher education sector [31].

## 2.2. Students' Reflections, Engagement, and Experiences

Reflection is described as the output of a cognitive process to learn from experience [32]. Reflection can also be described as having a "conversation with oneself" as you raise questions, evaluate results, consider solutions and possible changes. Individual reflection commences as collaboration between students and educators that usually forms part of group work activities [33]. Reflection ensures the enhancement of students' professional development at a tertiary level. The enhancement of students' learning performance has been associated with the use of reflection in an online teaching mode. When self-reflection is applied in an online environment, learning and learning strategies are enhanced via sharing ones' thoughts and experiences [34]. Reflection could also be used as a means to guide students' future learning and it promotes active student engagement [35].

Research has confirmed that student engagement acts as a detectable indicator of the online learning quality and satisfaction with the learning process. Student satisfaction is a reliable criterion that reflects students' learning performance. In addition, research indicated that interaction among students, perceived support, and student motivation, were important drivers for online learning satisfaction. Therefore, to enhance the online learning quality and promote the sustainable development of students, it is vital to accentuate students' perceptions of their overall learning practice [36].

Student satisfaction is measured by asking students to rate the quality of their learning experience in a course. Student satisfaction is often used conversely with the perceived quality of instruction and student evaluation or-rating. Many studies have indicated that students are skilled enough to rate the quality of their learning experience, which positively correlates with outcome indicators such as the evaluation provided by trained observers, educators' self-evaluation, and student achievement [37].



### 3. Methodology

The research consisted of three parts, which are shown in Table 1. For the first phase, students ( $n = 39$ ) first received a case study, followed by the project resources and the ten steps to complete the research project. Students then critically reflected (qualitative) on each step of the 10-step research project. In the second phase, students' engagement was recorded, i.e., the number of visits and resources they used on the online learning platform to complete the food research project and module. For the third phase, the university's student experience survey was implemented to examine students' experiences with the food module.

**Table 1.** Research design.

Research Phase	Research Method	Research Sample
First phase (Food research project)	Case study, project resources and 10 research steps: Structured questionnaire (5 sections), e.g., Google forms Student reflection (Qualitative) from critical evaluation	$n = 39$
Second phase (Food research project and food module)	Case study, project resources and 10 research steps: Structured questionnaire (5 sections), e.g., Google forms Student reflection (Qualitative) from critical evaluation	$n = 39$
Third phase (Food module)	Student engagement (visits and use of resources): e-Fundi platform Student experience survey: Structured questionnaire (3 sections), Google forms	$n = 39$

#### 3.1. Case Study

Within research, the problem statement evolves from the background information and fulfils the function of providing the reader with a definitive description of the problem addressed by the research [38]. The use of real-life scenarios in the form of case studies, could strengthen problem solving skills [39]. Students were provided with the following case study:

"Within the past three years, e-commerce sales increased by 77%. Nevertheless, online retailing seems to be highly product-category specific. For example, while more consumers buy products like clothing, music, or books via the Internet, only a small percentage of consumers purchase food items online. The recent trend is problematic due to the fact that online grocery shopping could solve problems like limited access to healthy and fresh products. Thus, buying foods online, represents one solution to providing health products in so-called food deserts. Consumers rely on haptic information during the decision-making process to select the best item, reduce uncertainty, and experience enjoyment when touching objects. The missing haptic (i.e., touch) input during online shopping, significantly impacts the decision-making process on products such as perishable produce. Consumers want to experience products personally before committing to the purchase. Accordingly, consumers' need-for-touch can lower the appeal of online grocery shopping [40]. Company X is concerned on how much do consumers actually rely on the need-for-touch when doing online food purchases on their website and how it affects their decision-making process and emotions towards these food products. Your company (i.e., group name), an established and well-respected business, is mainly concerned with consumer research. You have been hired by Company X to manage a quantitative online food research project. You will have to recruit respondents to partake in your research study. For your inclusion criteria, respondents should: be male and female older than 18 years of age; have access

to an internet connected device; and are currently not employed by any food retailer. An electronic questionnaire should be compiled and used to collect quantifiable data from the respondents. You will have to process and interpret the data to compile your report, presentation and critical reflection”.

### 3.2. Project Resources

Students can only know what is expected of them when educators provide clear and concise instructions [41]. Students received a number of resources to initiate self-directed- and self-regulated learning on the eFundi [42] learning management system, i.e., the university’s e-learning and -teaching platform that connects registered students and educators online. Students received the following resources to complete the food research project:

1. sufficient literature on the background and methodology of the research project;
2. recorded Zoom lectures with Microsoft PowerPoint slides to explain the research project;
3. four incomplete objectives;
4. a questionnaire template;
5. a work schedule guideline;
6. a recorded Zoom lecture to explain data analysis on Microsoft Excel;
7. a Microsoft Excel template for data analysis and outlay of tables;
8. a Microsoft PowerPoint template for the presentation;
9. evaluation criteria for the report and presentation; and
10. recorded Zoom meetings to address questions and/problems.

### 3.3. Research Steps

Students were requested to complete the online food research using a 10-step approach.

#### 3.3.1. Step 1: Choose a Consumer Product/Category

Students were instructed to decide on any food product/category (e.g., fruit, vegetables, cakes) that is already available on Company’s X website for online purchases. Educators could therefore choose any other non-food items (e.g., clothes, smartphones) when running a similar consumer research project.

#### 3.3.2. Step 2: Formulate the Aim and Objectives

Based on the provided case study in Section 3.1, students were informed to formulate their own aim for the research project and to complete the following objectives that were provided to them:

1. To determine consumers’ demographic characteristics (e.g., gender, age, level of education);
2. To determine the type of interface (e.g., smartphone, tablet, laptop) used during online food purchases;
3. To evaluate consumers’ need-for-touch (i.e., the need to touch the food product during online food purchases) of X (X refers to the chosen food product as described in Step 1) during online food purchases; and
4. To assess consumers’ emotional and sensory response (i.e., consumer behavior variables used in the Consumer Sciences discipline) of food product X during online food purchases.

Educators could therefore formulate applicable objectives for the online research project, however the appropriate NQF level [12] as well as the number of objectives should be kept in mind as to determine the level of composition or completion since the level of cognition differs between for example first year and fourth year undergraduate students.

#### 3.3.3. Step 3: Compile an Electronic Questionnaire

For step 3, students were instructed to compile an electronic questionnaire. Researchers can send electronic questionnaires to respondents without any obligation to conduct a face-to-face survey. Well formulated structured questionnaires, makes it easy to collect quantifiable data from respondents [43]. Structured questionnaires are defined as

questionnaires that contain fixed questions, sets of matching questions, and scales with predetermined answer options [44]. To compile and distribute a structured questionnaire electronically, only a working computer and network is needed.

For the development of the electronic questionnaire, students chose suitable computer software such as Google Forms or SurveyMonkey, of which they received no pre-training from the educator. Students were provided with a questionnaire template, consisting of standardized questions [40] of which they developed two new sections related to consumer behavior—namely, emotional response and sensory appearance attributes.

For this research project, the questionnaire contained the following sections:

1. An introduction as to provide the scope of the research study, to obtain consent from the respondents, and to provide a suitable electronic link of company's X website for respondents to interact with the chosen consumer product online;
2. The inclusion criteria as stipulated in the case study (Section 3.1);
3. Section 1—demographic information such as age and gender (provided);
4. Section 2—interface type (provided);
5. Section 3—need for touch (provided);
6. Section 4—emotional response (self-developed); and
7. Section 5—sensory appearance attributes (self-developed).

#### 3.3.4. Step 4: Develop Own Sections in Questionnaire

Students were instructed to develop two sections for the questionnaire—namely, emotional response and sensory terms. For the emotional response section, students compiled a list of five emotions in the form of emojis [45–47] with its meaning, e.g., ☺—Happy, containing both positive and negatives emotions, using the Check All That Apply (CATA) methodology [48]. A CATA question, consists of a list of words where respondents can mark any number of options that they consider applicable or appropriate. For the sensory terms, students compiled a list of four sensory attributes (e.g., smooth, hard, crispy, etc.) that described the appearance of the food product, using the CATA method [49]. Students were instructed to consult scientific articles on emotional response and sensory attributes related to food products. Educators are encouraged to use standardised questionnaires comprising of an unvarying set of questions that respondents answer themselves after using a product. They are considered reliable, valid to measure and economical to apply [50].

#### 3.3.5. Step 5: Complete and Test the Questionnaire

For step 5, students were instructed to send the educator the final link of the completed electronic questionnaire for approval before sending it to their recruited respondents. Students were reminded to customize the question settings (e.g., survey status, response quota, closing date of survey, survey timer, prevent duplicate responses, ensuring responses are anonymous and adhere to the study's inclusion criteria). Inclusion criteria is an important measure to ensure the accurate description of the target population [38]. Furthermore, technical aspects such as a consistent font size, spacing, use of language and grammar, were checked.

#### 3.3.6. Step 6: Recruitment of Respondents

Students should have recruited enough respondents to receive at least 20 completed questionnaires. Students were reminded that: (1) all respondents should first give consent to partake in their study; (2) the respondents may withdraw at any time; and (3) personal information will not be requested as to ensure that the project was administered in an ethical manner. Students should be made aware that scientific integrity is an essential component of research ethics [51].

#### 3.3.7. Step 7: Data Collection

Students tested their questionnaire before sending the electronic link to their recruited respondents. In addition, students were reminded that all collected data will only be used



to complete their project assignment. During this step, educators should remind students of the provided timeframe for completing the research project on time. Furthermore, students should be encouraged to collect the required data in the shortest possible time. For the online food project, data collection took place one week during April 2021. When students are provided with a shorter timeline, they are more likely to complete the task since there is no time for them to put off the task [52].

### 3.3.8. Step 8: Analysis and Interpretation of Data

For step 8, students exported the collected raw data to Microsoft Excel for data analysis. A Zoom lecture assisted the students on how to analyze the data on Microsoft Excel to perform basic descriptive statistics (frequencies, percentages and mean values). Students were also provided with a Microsoft Excel template to ensure a uniform display of the results for the compilation of the report and presentation. It is important that students develop a particular degree of competence and understanding of basic statistics at an early stage as statistics are present in everyday life. Furthermore, students should learn the skill to collect, analyse and interpret data, ask questions, communicate, and conclude the findings [53].

### 3.3.9. Step 9: Compile the Report and Presentation

Students' competency to communicate in written and verbal format along with comprehending and writing reports, and compiling and giving presentations, entails communicating effectively. Communication skills including the ability to write and speak clearly and to listen, and spell correctly, are of great importance [51]. During the preparation of the presentation, students learned how to write summarized reports [20]. For the report, students were provided with a template and evaluation criteria. Functional teaching and assessment tools such as evaluation criteria assist students consciously in the skills they need to obtain and improve upon [19]. The evaluation criteria helped the students in being more particular and thorough in their argumentation and motivated them to become more actively engaged in evaluations [54]. Students were reminded that under the results section, the most important findings should be reported, while under the discussion section, findings should be supported with suitable literature from scientific resources and the results should not have repeated in the discussion.

As part of the discussion, students summarized their findings by evaluating and explaining to Company X: 1. how much do consumers actually rely on the need-for-touch of the chosen food product when doing online purchases; and 2. how it affects their emotions towards these food products. Students also made possible recommendations to Company X on how they could improve their online shopping experience, especially with the inclusion of the chosen food product. It is therefore important to ensure the attainment of ideal skills and reflect real scenarios in a work environment [15].

Presentations could provide an indication of the skills attained, especially ICT skills, because the use of evaluation criteria can assess the different types of information students use, if they know how to use the software or technology correctly and if they can communicate sufficiently [55]. For the presentation, students were provided with a template and evaluation criteria to compile the presentation on Microsoft PowerPoint with voice recordings. Students were reminded to: 1. speak clearly; 2. keep to the agreed time; 3. use visual material appropriately and; 4. present in a scientific and professional manner.

### 3.3.10. Step 10: Compile a Critical Evaluation (Students' Reflections)

Project-based learning enhances students' critical thinking which occurs when knowledge learned is applied in a complex manner [56]. By means of assessing actions and decisions, critical reflection may support students' development professionally. Research methods in health- and social sciences, have approached critical reflection as an assessment option to overcome biases in knowledge development. Therefore, students can strive to be more objective when awareness of their personal biases improve [57]. Students crit-

ically evaluated and reflected on the ten steps (Sections 3.3.1–3.3.10) of the online food project. Recommendations were therefore provided on how the online food project can be improved for future research.

### 3.4. Students' Engagement

To determine students' online engagement, data on students' ( $n = 39$ ) visit to the e-learning platform and their use of resources on the platform to complete the online food project and module, were captured by the university's e-Fundi platform and exported to Microsoft Excel to calculate the sum values of the visits and use of resources over a 15-week period.

### 3.5. Students' Experiences

Students ( $n = 39$ ) received an electronic link to the university's student experience survey from the Centre of Teaching and Learning (CTL). The self-administered questionnaire was compiled on Google Forms and consisted out of three sections. Section 1 measured the educators' teaching and learning practices that included module evaluation (4 statements), assessment practices (5 statements) and the educational approach (8 statements). Section 2 determined students' perceptions (8 statements) of the module and remote teaching and learning. A 4-point Likert scale (1 = strongly agree; 2 = agree; 3 = disagree; 4 = strongly disagree) was implemented. Section 3 qualitatively measured students' experience of the module consisting out of five questions. The university shared the lectured modules' survey report with the educator via NextCloud.

## 4. Results

### 4.1. Research Project Steps (First Phase)

Figure 3 presents a 10-step approach to complete an online food research project with the applicable NQF level outcomes [12] and Bloom's Taxonomy level [28] to enhance students' higher-order thinking skills. For this project-based learning approach, the NQF level of seven was continuously kept in mind. All 39 students completed the 10-step research project successfully.

For steps 1–3, the outcomes that stimulated students' lower order thinking skills, namely, the scope of knowledge, knowledge literacy and problem solving, were successfully met. Steps 4–6 successfully met the outcome of the applicable method and procedure used in the online food project, stimulating higher-order thinking skills. For steps 6–8, the outcomes that mostly stimulated students' higher-order thinking skills, were ethics and professional practice, and assessing, processing and managing information. Steps 9 and 10 successfully met the outcomes of students producing and communicating information, managing their learning and being accountable during the completion of the research project.

### 4.2. Students' Reflections (First Phase)

Table 2 indicates students' reflections made from the critical evaluation of the research project (Step 10, Figure 3). Firstly, for their scope of knowledge (Steps 1 and 2, Figure 3), it was recommended that "...the research method can be changed from a quantitative research study to a mix method approach". Secondly, to apply the method and procedure of the project correctly (Steps 3, 4 and 5, Figure 3), it was suggested that "a pilot test should be done...to determine if the questions are interpreted as it was intended to". Thirdly, to access, process and manage information properly (Steps 6, 7 and 8, Figure 3), students recommended that "Future research should include a larger study population..." and an "equal age-and gender distribution". Lastly, to communicate the information and manage their learning (Steps 9 and 10, Figure 3), it was suggested that "Results should be stated clearly in the discussion in order for the reader to understand".

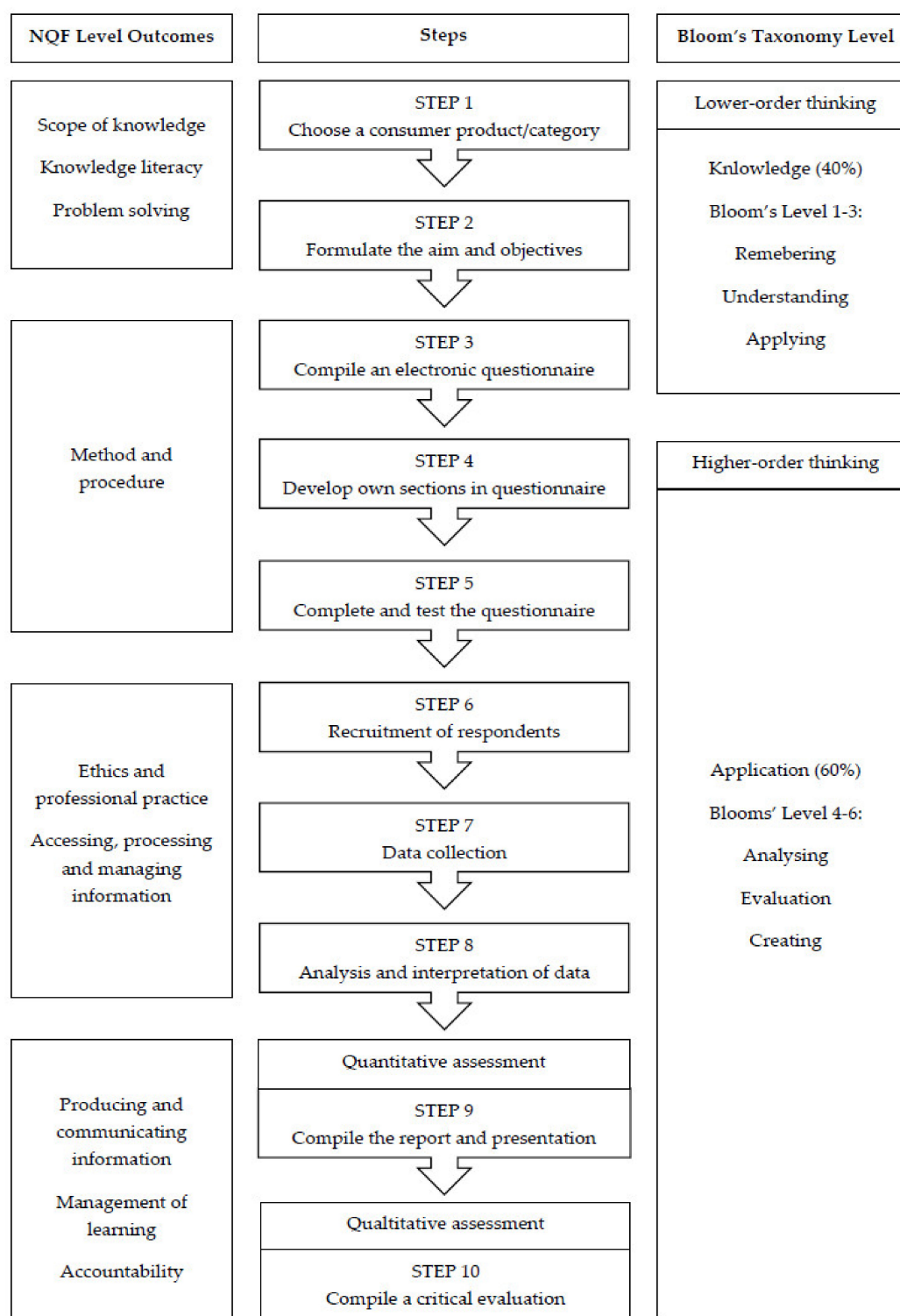


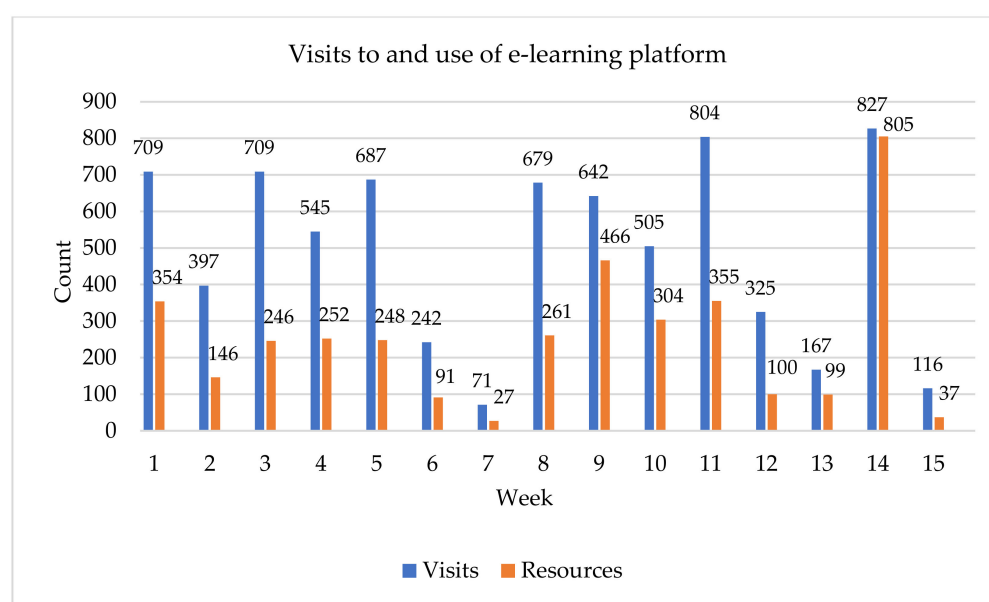
Figure 3. Ten steps to complete an online food research project.

**Table 2.** Students' reflections from the critical evaluation of the online food project.

Step	Recommendation
1. Choose a consumer product/category	<p>"Use products that are easy to identify in a specific retail category are used for the study".</p> <p>"For future research I would recommend that a food group or a wider variety of products be used to gain a broader insight to consumers' needs and the way they make their purchase decisions with need for touch in mind".</p>
2. Formulate the aim and objectives	<p>"As an attempt to improve the project, the research method can be changed from a quantitative research study to a mix method approach".</p> <p>"By including both a quantitative and qualitative approach the data gathered will be richer and will provide a better explanation as to why consumers do not want to buy fresh grocery items online".</p> <p>"There should have been a balance between open ended questions after a closed ended question as well as a balance between all the other types of questions".</p>
3. Compile an electronic questionnaire	<p>"The questions in the questionnaire should also be re-evaluated to ensure it is relevant and understandable".</p> <p>"The questions were unclear for some people to understand, although we have the knowledge of the subject and topic. Therefore, changes must be made on the questions, by simplifying what is asked and explaining the topic more efficiently".</p>
4. Develop own sections in questionnaire	<p>"More scales can be used that do not have "moderate" answers; thus, it will improve the trustworthiness and applicableness of the results that are received".</p> <p>"If the survey was of better quality with stronger questions to the consumers, more clear and better results would've been accumulated from it".</p>
5. Complete and test the questionnaire	<p>"A pilot test should be done where an amount of respondents fill out the questionnaire in order to determine if the questions are interpreted as it was intended to".</p> <p>"Doing a pilot test with the questionnaire, one could see if it is difficult to answer the questions, if the order of the questions is best sequenced, to implement more questions or less if needed, and if the instructions were clear".</p>
6. Recruitment of respondents	<p>"Future research should include a larger study population of at least 300 respondents to gain a broader perspective and to ensure that potential sampling errors are reduced and an established a representative sample".</p> <p>"Respondents should be anonymous and regarded with objectivity, which is not the case with family and friends".</p> <p>"By broadening our recruitment platforms (e.g., with social media), more respondents can be reached at the same time, resulting in more diverse respondents".</p> <p>"In future reliability of the result can be improved employing a probability sampling method such as simple random sampling".</p>
7. Data collection	<p>"It is suggested that respondents first complete a questionnaire to determine their need-for-touch score as an equal distribution of these scores are needed to collect accurate results".</p> <p>"Future research should include an equal age- and gender distribution".</p>
8. Analysis and interpretation of data	<p>"An option of "none of the above" or a neutral sensory term in the sensory part of our questionnaire can be added as a few respondents felt none of the evaluations applied".</p> <p>"There should be more than one researcher to feed the data into the excel sheet, analyzing the data and interpreting the data".</p> <p>"The results could be analyzed and interpreted by more than two researchers to better understand and fully interpret the information to ensure that all aspects are addressed correctly".</p>
9. Compile the report and presentation	<p>"It is not necessary to interpret all the results. Only values of significant can be stated in the interpretations of the results and in the discussion segment".</p> <p>"Results should be stated clearly in the discussion in order for the reader to understand".</p> <p>"In the discussion segment, all the statements that are made should be supported by literature".</p> <p>"The report should be structured in a logical manner. This includes using headings and sub-headings, allowing the reader to find claims or facts needed under these headings".</p> <p>"Proper references and referencing lead to a report that is supported by enough other scientific papers to make the study relevant and understandable".</p>
10. Compile a critical evaluation	<p>"A critical evaluation of a project gets approached in a way that strengths and weaknesses get weighed up against each other and opinions get lifted to strengthen facts and eliminate weaknesses".</p> <p>"This project can be improved by practical methods which were not sufficient previously. These include factors such as time management and prioritization of work amongst team members, to be able to increase the quality of this assignment".</p>

#### 4.3. Students' Engagement (Second Phase)

Figure 4 indicates the sum of visits to, and use of, the eFundi platform [42] over a 15-week period to complete the online food research project. For weeks 1, 3, 5, 8 and 9, visits to the eFundi site exceeded 680 during which students were working on the different steps of the food project. The low visit count for week 7 were assigned to the university's recess period. The high visit count for weeks 11 and 14, were ascribed to the final preparation of the project report and presentation, and the final assignment, respectively. For week 9, the sum of resources exceeded 450 during which students submitted their project report. Week 14 indicated the most use of resources when students completed their final assignment (information on the final assignment has been excluded for this article).



**Figure 4.** Visits to and use of the e-learning platform.

#### 4.4. Students' Experiences (Third Phase)

Table 3 provides an overall evaluation of the educators' teaching and learning practices (Section 1 in the student survey) consisting of three constructs i.e., educational approach, assessment practices, and module evaluation.

For the educational approach, 95.8% of the students agreed that the educator used the e-learning platform as the main platform to share resources, communicate with students, collaborate, and upload/create assessment.

For the assessment practices, 93.8% of the students agreed that the educator used a variety of assessment strategies (such as tests, assignments, portfolios, case studies, videos) to assess their learning. Furthermore, 93.8% of the students agreed that the educator provided enough ongoing opportunities to evaluate their learning through regular assessments.

For the evaluation of the module, 87.5% of the students agreed the module had clear learning outcomes that enabled them to understand what is expected of them and the module content developed their knowledge and skills regarding the module. However, there is room for improvement on the educators' feedback on assignments and assessments (83.3%) and the organization of the contents and the ease of accessibility to the university's e-learning platform (83.3%).



**Table 3.** Educators' overall evolution from the student experience survey.

<b>Educational Approach</b>	<b>Percentage</b>
The educator explained concepts in an understandable way	89.6%
The educator gave clear instructions on where to access my study material and how to complete my assignments	93.8%
The educator provided a platform where students could ask questions and communicate with other students and the educator	91.7%
The educator was available for online consultation/scheduled meetings	93.8%
The educator was generally present in the modules through announcements, emails and feedback	93.8%
The educator used eFundi as the main/central platform to share resources, communicate with students, collaborate, and upload/create assessment	95.8%
The educator used a variety of teaching strategies (e.g., video lectures, online group work, online discussions, project-based learning) to support my learning	93.8%
The educator used a variety of resources (e.g., narrated PowerPoint presentations, textbooks, videos, podcasts) to support my learning	89.6%
<b>Assessment Practices</b>	
The educator used a variety of assessment strategies (e.g., online quizzes, tests, assignments, portfolios, case studies, videos) to assess my learning	93.8%
The educator provided enough ongoing opportunities (e.g., eFundi tests, activities) to evaluate my learning through regular assessments	93.8%
The continuous assessments of this module gave a true reflection of my knowledge	87.5%
The assessments of this module challenged me to reflect critically on the material that was presented	91.7%
The educator provided feedback on assignments and assessments that improved my understanding of the module	83.3%
<b>Module Evaluation</b>	
The module had clear learning outcomes that enabled me to understand what is expected of me	87.5%
The module content developed my knowledge and skills regarding the subject or course	87.5%
The learning activities in this module supported me to gain a deeper understanding of the content	85.4%
The module content was organized in a logical structure and was easily accessible on eFundi (i.e., I navigated easily between the various documents, links and activities)	83.3%

Table 4 indicates students' perceptions (Section 2 in the student survey) of the module and remote teaching and learning. Students confirmed that they felt comfortable approaching the educator with questions (93.8%); they were satisfied with the support and guidance they received from the educator (91.7%); and they felt that they have gained skills in this module that are valuable for their future career (89.6%). During the pandemic, students did however feel that they were struggling more on their own to comprehend some aspects of the project and they also felt less confident in their ability to apply what they have learned in the module.

Qualitative feedback on students' experience for this module is presented in Table 5 (Section 3 in the student survey). Regarding the first question on what students liked most about this module, statements revealed the attainment of skills, for example "doing research and compiling reports", "experiencing the analysis of data", and "I really feel that the knowledge I have gained will help me in my future to contribute successfully to my specific field".

**Table 4.** Students' perceptions of the module and online teaching and learning.

Statement	Percentage
I feel comfortable approaching the educator(s) with questions.	93.8%
I am satisfied with the support and guidance I receive from the educator(s) in this module	91.7%
I feel that there are too many assessments that I have to do in this module *	50.0%
I feel that it is easy for students to cheat in the online assessments of this module *	39.6%
I am confident that I can apply what I have learned in this module	81.3%
I feel that I have gained skills in this module that are valuable for my future career	89.6%
I did not have to struggle on my own to figure things out	75.0%
All the study material that I needed for this module was made available online	85.4%

Note. \* A lower percentage indicates a better outcome.

**Table 5.** Qualitative feedback on students' experiences.

Question	Feedback
What did you enjoy/like most about this module?	<p>"The assessment was not too much".</p> <p>"I enjoyed using my own initiative".</p> <p>"The interesting content and the flexibility to handle the work at our groups own pace".</p> <p>"Doing research and compiling reports".</p> <p>"There was a very clear work schedule that we stuck to".</p> <p>"All assignments were clear and well planned out".</p> <p>"I liked that we had non-compulsory zoom sessions where you could ask questions about something you struggled with, and didn't have to sit through a whole session"</p> <p>"The recordings are complete, and we always knew what is expected of us"</p> <p>"Experiencing the new analysis of data"</p> <p>"I really feel that the knowledge I have gained will help me in my future to contribute successfully to my specific field"</p>
What did you like least or what did you struggle with most?	<p>"To understand the assignments that use Excel"</p> <p>"I feel that our assessments were strictly marked"</p> <p>"Read of literature".</p> <p>"Group work under COVID circumstances".</p> <p>"Working in a group".</p>
What suggestions do you have to improve the remote teaching and learning experiences of this module?	<p>"Less group work, more individual work".</p> <p>"I think YouTube tutorials will help to understand complicated concepts, but the videos that the educator made, helped me".</p>
If you could take one thing from this module that you wish were present in other modules, what would it be?	<p>"Video educators".</p> <p>"The recordings you can work through your own pace".</p> <p>"The fact that the educator is well prepared and organized".</p> <p>"The structure of the module".</p> <p>"Work schedule was well planned out and clear".</p> <p>"Assignments were planned and where not added on as educator saw fit".</p> <p>"The communication and voice recording that was so complete was really a great asset to us as students".</p> <p>"Good and clear communication".</p> <p>"The tutorials".</p>
Is there anything that is limiting your ability to participate in online learning activities?	<p>"Compulsory zoom/team sessions make it difficult. When studying from home it is not always possible or convenient to attend online sessions".</p> <p>"Interaction".</p>

For question two, on what students liked least about the module, and question three, possible suggestions to improve the remote teaching and learning experience, students' non-preference for group work was noticeable, for example "Less group work, more

individual work.” For question four regarding students’ desire of one component of this module to be present in other lectured modules offered in their curriculum, students revealed that they would like “video educators”, “recordings you can work through your own pace”, “good and clear communication”, and “tutorials”.

The last question inquired if students experienced any limitations to participate in online learning activities which was not necessarily aimed at this module. Students indicated that the attendance of compulsory Zoom/Teams sessions, makes it difficult as well as the absence of interaction with their fellow classmates and educators.

## 5. Discussion

### 5.1. Project Steps

According to South Africa’s SDG 2019 Country Report [58], ICT skills are lower than other countries with which the country needs to compete, as well as collaborate internationally, therefore, increasing this percentage, should be a key objective in the tertiary education sector and government policy in South Africa.

The learning approach for this consumer research project was classified as project-based learning as groups of students critically solved project-based problems that provoked skill diversity as students collected their own knowledge through raising questions and identify and solve problems through the use of gathered information technology based platforms and communicating to their group [59]. Regardless of the educators’ pedagogy approach, the focus remained on students that must complete an online research project in group format where ICT were used to achieve the set goals and timelines, and consumer related problems were solved [60]. Educators should always consult the levels of NQF and Bloom’s taxonomy [61] to integrate the appropriate list of competencies and manage the degree of difficulty before running an online consumer science research project. Level descriptors encompass learning in different settings (professional, academic vocational and occupational) and environments (laboratory, classroom, field) [12].

A 10-step research approach was proposed to assist educators on how to initiate and administer an online consumer sciences food research project within their modules. These steps could help students to complete an online research project successfully from which they could acquire the necessary ICT skills. Implementing the ten steps could ensure that the quality of teaching and learning is sustainable and will abide to the SDG 4, target 4.4 that aims to “to increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship” by 2030 [62]. Communicating basic research steps will stimulate educators’ ideas to apply higher-order and innovative research tools when imitating consumer research projects for undergraduate students and also to aspire them to apply their creativity regardless of their focus within the consumer sciences discipline.

After the completion of this research project, students order of thinking transitioned from low to high as they realized the value and importance of project-based learning and critically evaluating their projects and identified improvements to ensure a more efficient and successful outcome for future research. Research confirmed that the inclusion of a technology-enhanced learning environment, will stimulate higher-order thinking as different ideas to think more creatively, are provoked and students’ perspectives are broadened [63]. Higher-order thinking involves the proficiency to implement values, skills and knowledge in thinking, decision making, creating, innovating and reflecting [64]. The fundamentals to advance higher order thinking skills include thinking analytically, creatively and critically in the solving of problems [21].

Running a consumer sciences food research project online during the COVID-19 pandemic has demonstrated a successful method for students of acquiring consumer-friendly technology to collect data. In order to increase the success of such online project, the necessary resources (Section 3.3), investment in quality control and careful design and planning is required [65].

Should the educator decide to publish the findings gathered from the research project, approval must first be obtained from the institution's Scientific/Ethics committee. Ethical principles act as a guideline and should be interwoven throughout the research process to ensure high ethical standards [66,67].

### 5.2. Students' Reflections

The online food research project gave compelling insight into what components need improvement prior to further use as students identified different aspects within the different NQF Level Outcomes (Figure 3), namely scope of knowledge (Steps 1 and 2), to apply the method and procedure of the project correctly (Steps 3, 4 and 5), to access, process and manage information properly (Steps 6, 7 and 8) and to communicate the information and manage their learning (Steps 9 and 10). When new technologies are introduced, it is important to collect students' perspectives [68]. Reflection can advance more effective learning and stimulate higher-order thinking. Students will extend their comprehension beyond their competencies to diversify their thinking if reflection occurs within smaller interconnected skill-based assignments [69].

### 5.3. Students' Engagement

Using an e-learning platform that could provide a visit count as well as the number of resources used on the online platform, produce valuable information to the educators during a pandemic. However, as derived from students' perceptions, universities could improve the structural flow of and accessibility to these e-learning platforms.

Engagement consists of three dimensions, namely behavioral, cognitive and affective which had been acknowledged in the literature [70]. In the context of e-learning, engagement can emerge as behavior attributes, such as managing learning using the online system. Activities that emphasize learner-initiated skills in managing online learning include the number of logins, lecturers attended, and assignments submitted [71]. Learning outcomes are influenced by the time students spent in study and their engagement with different course activities. Students who successfully completed a course, were highly committed towards online learning resources and regularly submitted assignments [72]. Studies have shown that persistence and consistency in learning activities are correlated to successful performance and student engagement, meaning that when students are motivated to revise learning activities more than once and they endure in their effort to learn, they will develop beneficial learning skills which is related to their engagement in the course [73]. Currently, research on the associations between student engagement and online learning environments revealed that student-perceived support, such as peer facilitation and purposeful feedback from the educator, was positively correlated to students' online learning engagement. Furthermore, where students had the opportunity to repeatedly access learning resources, they were more involved in an online learning context [36]. Educators should explore methods for strengthening students' engagement in online learning and also keep tracking their learning and engagement to establish what may be impeding their participation. This measure is crucial, as students' participation and engagement greatly impact their academic performance [74].

### 5.4. Students' Experiences

With the transitioning to an online teaching mode, most of the students responded well to the online learning platform, however a valuable lesson learned during this online approach is that although students suggested to rather work individually to improve their online learning experience, they struggled to grasp some of the module content. Online learning disrupted group work, discussions and interactive assignments [75] as students yearned for interactions between other students and their educators.

In the online learning environment, isolation is often regarded as a considerable challenge that students experience in online learning [76]. A study done at American universities reported that 65% of the study participants were of opinion that teamwork

was inadequate in an online learning environment. This may influence students' level of satisfaction and could result in feeling isolated. Students feeling isolated in an online learning environment can be harmful as it can make students feel excluded that they are not affiliated to an academic community [77].

Human interaction dictates how well learning will occur in any educational environment. Education can be regarded as an interaction among the educator, student and subject content. Three different types are identified. Firstly, student-content interaction in online education refers to students' perceptual and cognitive contact with various types of e-content (e.g., e-journals, websites, audio-video) that should be studied in the course. An important determinant of students' positive experience and satisfaction in online learning is their ease of access to e-content. Therefore, developing interactive e-content such as MOOC [28,29], serious games [30,31], video clips, podcasts, infographics and quizzes, is vital in creating a quality online learning experience for students [78].

Secondly, student-educator interaction is portrayed by the educator's availability and presence to understand students' learning needs and providing prompt feedback to students. Improved student-educator interaction leads to greater student satisfaction and belonging to an academic community. Interactive engagement between students and educators was notably impeded by shifting the food project online, as face-to-face contact sessions encourages to build relationships that can be advantageous for engagement in classes. Therefore, building relationships in the online learning context was challenging with the lack of contact between students and the educator. Evoked emotions such as interest, enjoyment and a sense of belonging is an indication of students' emotional engagement which improves their classroom engagement. During the completion of the online food project, it was difficult for students to achieve this emotional engagement as they were less engaged due to other responsibilities and less time spent with educators [78].

Thirdly, student-student interaction refers to interaction that occurs among students in the presence or absence of the educator. Research has reported that a higher student-student interaction in the online learning context could increase student satisfaction. Running an online food project may pose many difficulties, resulting in discontinuous learning opportunities and reduced engagement. Nevertheless, with online learning, students are in a position to learn in a location that is convenient for them, and they could complete activities at their own pace. Therefore, for future learning, an approach that is more flexible (e.g., hybrid approach) and interactive, could be beneficial with increased student engagement [78].

In addition, students also seemed to be less motivated and confident in their application ability learned from the project. Researchers found that many students felt stress, anxiety, a lack of motivation and isolated during the COVID-19 pandemic [79]. Motivation dictates the extent of learning that happens in all learning environments. A defining factor for students' success and satisfaction with online learning is self-motivation.

However, while an educator's learner-centered pedagogy can encourage students to frequently attend online classes, challenges such as the lack of a learner-friendly context at home and poor Internet connectivity, can hinder student's motivation [77]. Researchers reported 79% of their respondents indicated the hardship for learners to stay motivated during online learning [80].

As the online food research project's aim was to facilitate learning, it was regarded a success as the students appeared to enjoy completing this project as well as learning about quantitative research and the topic on the Need-For-Touch during online food purchases (Section 3.1) within the consumer sciences discipline. Students also learned about how this project linked to the bigger context of consumer behavior during the COVID-19 pandemic.

## 6. Conclusions

Together with students' experiences (qualitative data), this paper suggested a basic 10-step approach for students and educators to complete an online food research project during a global pandemic. Running a food project online served as a learning and engagement



experience for future learning opportunities, as a more flexible and hybrid approach could be beneficial to reconsider conventional methods of learning and to increase student engagement. Lecturers have a continuous responsibility to help students discover their own support networks, provide opportunities and events to share their values and work, and motivate and encourage student engagement and reflective discussions in the online learning environment in order to stimulate higher-order thinking and enhance students' professional and sustainable development.

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**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki. The student experience survey was approved by the Centre of Teaching and Learning (CTL) of the North-West University (<http://services.nwu.ac.za/ctl>, accessed on 6 September 2021).

**Informed Consent Statement:** Informed consent was obtained from all students involved in the study. The respondents were reassured of their confidentiality and the privacy of the information that they supplied. Students had to agree to a declaration before commencing with the student experience Survey: "By completing and submitting the survey, you declare that you are fully informed of the purpose of the questionnaire and give permission that the data for this survey, combined with other data on the University's Student Information System, may be used for research purposes without identifying you as an individual".

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author.

**Conflicts of Interest:** The author declares no conflict of interest.

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