
# Exploring Models and Approaches for Training Sustainable Food Systems in Dietetic Practice: A Pilot Study

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**Abstract**

**Background:** A Sustainable Food System (SFS) is an emerging area in dietetic practice that addresses food waste, hunger, malnutrition, and ensures that everyone has access to safe, affordable food while preserving biodiversity.

The International Confederation of Dietetic Associations (ICDA) has developed three online learning modules to train nutrition professionals in SFS. However, the effectiveness of these modules has yet to be evaluated.

**Objective:** This study evaluates the effectiveness of the ICDA's online learning modules in enhancing dietitians' confidence and competency in incorporating SFS principles into their practice.

**Methods:** A mixed-methods approach was employed, with 25 participants from Canada and Australia recruited through purposive sampling. Participants engaged in three 90-minute online focus group sessions and completed baseline and three-month follow-up surveys to assess confidence and competency in SFS. The focus groups evaluated the modules' design, content, and impact on knowledge and practice. Focus group data were analyzed using thematic analysis.

**Results:** After completing the ICDA modules, the three-month follow-up survey revealed increased competence and confidence compared to baseline, indicating a positive impact of the modules on dietetic professionals. The focus group data showed that participants' competence and confidence were influenced by their learning environment and approach, engagement and interaction, application and practicality

**Discussion:** The findings suggest that the knowledge and skills gained through the ICDA modules can enhance dietetic professionals' confidence and competency in applying SFS

principles to their practice. This research supports the integration of SFS into dietetic practice, ultimately benefiting population health. These findings will be used by the ICDA to improve the modules for dietetic professionals.

## General Summary

This thesis explores the effectiveness of the International Confederation of Dietetic Associations (ICDA) online learning modules in enhancing dietitians' confidence and competence in Sustainable Food Systems (SFS). A SFS strives to reduce food waste while also ensuring everyone has access to safe, affordable, nutritious, healthy, and culturally appropriate food while prioritizing environmental protections.

As key healthcare professionals, dietitians are well-positioned to promote SFS in their practice. However, many of them lack the necessary knowledge, skills, and training to effectively integrate SFS principles into their practice. To address this gap, the ICDA developed three learning modules designed to educate and train dietitians in sustainable food systems.

The results of this study demonstrate that the ICDA learning modules are a valuable tool for dietitians to improve their understanding of SFS and learn how to incorporate these principles into practice. However, the modules have limitations and require further refinement to become more effective. The results of this study can help the ICDA improve their learning modules, making them a more impactful resource for dietetic professionals.

**Co-Authorship Statement**

This project was accomplished in collaboration with my supervisors, Dr. Rachel Prowse and Dr. Liesel Carlsson, along with my committee members, Dr. Olga Heath and Dr. Atanu Sarkar. The focus group moderators were Dr. Carlsson, the researcher Phebe Oluwafemi, and Dr. Rachel Prowse.

Phebe Oluwafemi analyzed the focus group data with input from Dr. Carlsson, Dr. Prowse, Dr. Heath, and Dr. Sarkar. The baseline and three-month survey questions were created by Phebe Oluwafemi, Dr. Prowse, and Dr. Carlsson, with guidance from Dr. Heath and Dr. Sarkar. The survey data was analyzed by Phebe Oluwafemi, with Dr. Prowse and Dr. Carlsson providing guidance.

Phebe Oluwafemi wrote this manuscript, Chapters 1–5, and edited it using suggestions from Drs. Prowse, Carlsson, Heath, and Sarkar.

The manuscripts in this thesis have not yet been submitted for publication.

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## Dedication

I dedicate this thesis to the Lord God Almighty. I am deeply thankful for Your love that continually surrounds me.

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**List of Abbreviations**

ICDA - International Confederation of Dietetics Association

SFS - Sustainable Food System

RD - Registered Dietitian

WHO - World Health Organization

FAO - Food and Agriculture Organization

UN - United Nations

US - United States

# Chapter 1: Introduction and Overview

## Thesis Outline

This chapter will introduce the study's focal point, Sustainable Food System (SFS), and outline the crucial role of dietetic professionals in it. This chapter will also outline the research aims, questions, and significance. In Chapter 2, relevant literature will be reviewed. Chapter 3 will analyze the effect of the International Confederation of Dietician Association (ICDA) module on dietetic professionals' competence and confidence. Chapter 4 will examine the impact of content and design features on dietetic professionals' confidence and competence. Chapter 5 will discuss the findings, recommendations, and conclusion.

### 1.1 Opening Section

In 1987, the United Nations defined sustainability as having the ability to meet the needs of the present without jeopardizing the ability of future generations to meet their own needs (United Nations, 2024). One of the most important sustenance we cannot live without as humans is food; the substance we eat and drink to maintain life (Kesari & Noel, 2023). Therefore, it is important for our food and the processes through which we receive it to be sustainable.

According to the Food and Agriculture Organization (FAO) (2018), our food system includes all processes involved in the production, transportation, processing, consumption, and disposal of foods. Unfortunately, our current food system contributes to numerous issues, including food waste, poverty, limited food access, resource depletion, soil degradation, global warming, and biodiversity loss (Holden et al., 2018; Zinsius, 2013). This unsustainability is evident in the fact that around 2.3 billion people in the world were moderately or severely food insecure in 2021 (World Health Organization (WHO), 2022). The FAO defines food insecurity as the lack of regular access to safe, nutritious, and affordable foods (FAO, 2023). A food system that systematically undermines the access 2.3 billion people have to food is neither meeting the

purpose of our food system nor is it sustainable because it undermines health (Meybeck & Gitz, 2017). Given that food is an essential component of survival, unsustainable processes involved in food production and distribution are concerning (Holden et al., 2018).

While hunger and malnutrition afflict an unacceptably large number of people in nations of all income levels (FAO et al., 2024), paradoxically, nations of all income levels also waste a substantial portion of the available food (Lopez & Hertel, 2020). For example, the United States (US) discards approximately 35 million tonnes of food annually, Japan discards 38 million tonnes, and Australia discards 4 million tonnes (Ishangulyyev et al., 2019). Globally, 1.6 billion tonnes of food are wasted yearly, while 828 million people go hungry (WHO, 2022). Even more disheartening is the fact that citizens in wealthier countries with high levels of food waste, like Canada, still face food insecurity, with approximately 2.3 million metric tons of edible food wasted annually and 6.9 million Canadians experiencing food insecurity (PROOF, 2023). This disparity between food insecurity and food waste highlights one of the inequalities caused by our current food system.

In response to the challenges faced by our existing food systems, the imperative solution is a *sustainable food system*. A *sustainable food system* strives to reduce food waste while also ensuring everyone has access to safe, affordable, nutritious, healthy, and culturally appropriate food while prioritizing environmental protections (Johnson et al., 2014).

The benefits of a SFS are numerous; for example, it can help address the rising rates of cardiovascular disease, obesity, diabetes, and other food-related illnesses. Many of these illnesses are linked to low consumption of fruits, vegetables, legumes, whole grains, nuts, fibre and increased intake of red and processed meats, sugary drinks, and trans fatty acids (WHO, 2019). These health-promoting dietary patterns very often have lower impacts across multiple

environmental indicators (Gammage, 2017). Moreover, a SFS contributes to environmental protection by reducing greenhouse gas emissions, preventing deforestation, minimizing livestock grazing, and ensuring that resources are sufficient for the present generation without compromising those of future generations (Johnson et al., 2014).

The significance of SFS is further highlighted by its inclusion in the United Nations' Sustainable Development Goals (SDGs) adopted in 2015 (United Nations, 2016). Among the 17 SDGs, four of them relate closely to SFS. SDG 2 calls for an end to hunger, improvement of nutrition, and promotion of sustainable agriculture (United Nations, 2023a). Achieving these objectives requires the promotion of SFS (Johnson et al., 2014). SDG 12, focused on ensuring sustainable consumption and production patterns, is another goal that aligns with the principles of a SFS. Rather than wasting resources and causing soil degradation, a SFS promotes responsible consumption and production (United Nations, 2023b; Zinsius, 2013). Further, SDG 13, addressing climate change, emphasizes the need to combat the impact of our food system, which contributes 21 to 37 percent of our total greenhouse gas emissions globally (United Nations, 2023c; Mirzabaev et al., 2023). A SFS would significantly reduce these emissions, contributing to lower climate change impacts (Gammage, 2017). SDG 15, which aims to protect, restore, and promote the sustainable use of ecosystems and halt biodiversity loss, aligns closely with the goals of a SFS (United Nations, 2022). Preventing biodiversity loss, reducing land degradation, and avoiding deforestation are integral components of a SFS (Johnson et al., 2014).

Recognizing the importance and necessity of a SFS, dietitians, as leading experts in nutrition, play a crucial role in guiding the public toward sustainable choices (Dietitians of Canada, 2021). Dietetic professionals, also known as dietitians, are regulated healthcare professionals who specialize in nutrition. They serve as nutrition experts, guiding the public, organizations, and

government in making informed nutrition choices (Dietitians of Canada, 2020). With a profound understanding of the integral role nutrition plays in health, dietetic professionals undergo rigorous education and training to provide nutrition education and support healthy living for individuals and communities. However, one area where dietetic professionals need further training is in SFS (Guillaumie et al., 2020).

### 1.2 Research Gap

Existing literature, such as the systematic review conducted by Guillaumie and colleagues in 2020, identifies a crucial gap in the knowledge and skills of dietetic professionals when it comes to incorporating the principles of SFS into their practice. These professionals require enhanced knowledge about SFS and need accessible resources to guide them in seamlessly integrating sustainable practices into their daily routines (Guillaumie et al., 2020).

Further support for this gap is found in the work of Heidelberger and colleagues (2017), who emphasize that dietetic professionals need increased knowledge as well as practical ways to apply this knowledge to their practice. Spiker and colleagues (2020) highlight the necessity for dietitians to undergo practical training to effectively communicate the environmental impact of food choices to their clients.

Wegener's commentary paper in 2018 critically examined the current training and education of dietetic professionals in Europe, Australia, Canada and the US, revealing significant shortcomings in the area of SFS. The existing training is noted to result in a limited understanding and engagement with SFS and their guiding principles. Furthermore, Penland's study in 2014 established a positive correlation between knowledge of SFS and the incorporation of SFS into practice among dietetic professionals. According to Penland (2014), increased

training and knowledge of SFS leads to a greater likelihood of dietetic professionals actively engaging with and applying SFS in their practice.

In response to these identified gaps, the ICDA, a global organization with national dietetic association members representing numerous dietetic professionals all over the world, developed three online learning modules to teach dietetic professionals about SFS (ICDA, 2023). These modules aim to address the need for increased training, knowledge, and practical assistance for dietetic professionals regarding SFS, providing practical examples to facilitate the integration of sustainable practices into their daily work. The three modules are meant to introduce dietetic professionals to SFS and provide ways and examples that dietetic professionals can incorporate SFS into their practice.

This research investigates if the three ICDA learning modules enhanced dietetic professionals' knowledge and skills in sustainable food systems and explores the specific models and approaches used in the modules that are most helpful for professional learning and support the integration of sustainable practices into their professional practice. The overarching question this research aims to answer is whether the ICDA learning modules fulfill the objectives they were designed to achieve and how the objectives were fulfilled.

### 1.3 Research Objectives

Given the lack of research on the training and education of registered dietitians[1] in sustainable food systems, this study aims to identify and evaluate the impact the three ICDA online learning modules have in assisting dietetic professionals in integrating sustainability into their practice.

[1] Throughout this paper, the terms "dietetic professionals" and "registered dietitians" (or simply "dietitians") will be used interchangeably.

## 1.4 Research Questions

1. How, if at all, do the ICDA online learning modules increase dietetic professionals' confidence and competence with sustainable food systems*?*
2. What content or design features are most effective in increasing dietetic professionals' competence and confidence?

In the context of this research, **competence** refers to the knowledge, skills, and abilities possessed by dietetic professionals in integrating sustainable food systems into their practice (Hooper et al., 2014). It involves having a thorough understanding of the principles, theories, and best practices related to sustainable food systems*,* as well as the ability to effectively apply them in practical situations (Hooper et al., 2014).

**Confidence**, within the scope of this research, is the self-assurance and belief that dietetic professionals have the capacity to successfully integrate sustainable food systems into their practice (Budin, 2017). It involves having trust in one's knowledge and skills, feeling comfortable, and being empowered to make decisions and take actions aligned with *sustainable food system* principles (Budin, 2017).

## 1.5 Research Significance

This research study holds significant implications for key groups and can contribute to the advancement of knowledge and practices in the field of dietetics and sustainable food systems. These groups include educators, organizations, universities, dietetic students, researchers, training program developers, and policymakers. Each group can utilize the insights from this study to enhance the application of SFS within their respective roles in the field of dietetics and sustainable food systems.

Education

This study provides valuable insights for educators teaching undergraduate dietetic students. It emphasizes the importance of incorporating SFS into dietetics education. Educators can use this research to advocate for the inclusion of SFS in curriculum development and recognize the need for up-to-date resources to effectively teach dietetic students.

Organizations

Organizations involved in food systems can leverage this research to understand the crucial role of SFS and to prioritize training and support for their workers. The findings can influence organizational strategies, encouraging a focus on sustainability practices within the food industry.

Universities

Universities offering nutrition programs can benefit from this research by recognizing the need to integrate SFS into their curriculum. This can guide universities in making SFS a priority in dietetics education, contributing to the preparation of future dietetic professionals.

Dietetic students

For dietetic students, this study emphasizes the importance of self-study in SFS. It serves as a reminder of the need for continuous learning in this area and encourages students to take an active interest in sustainable practices.

Researchers

The study serves as a pilot study, providing a foundation for further research in the intersection of SFS and dietetic training. Other researchers can build upon this study, expanding the scope and sample size to deepen our understanding of the subject.

Training program developers

The results of the research can inform the design of training programs for dietetic professionals. Developers can tailor programs based on the identified needs and challenges, ensuring that training is effective and beneficial for dietitians seeking to integrate SFS into their practice.

Policymakers

The findings can be used to inform policy changes related to dietitians and SFS. Policies may focus on promoting sustainable diets and acknowledging the link between a healthy diet and environmental sustainability.

The study also has the potential to positively impact population health by training dietitians in SFS, which promotes the adoption of healthier, environmentally friendly diets. Dietitians, armed with this knowledge, can guide their clients toward sustainable food choices, contributing to both environmental and public health.

In summary, this research study has broad-reaching implications, influencing education, practice, and policy in the field of dietetics and contributing to the overall promotion of sustainable and healthy food systems.

## 1.6 Conclusion

This introductory chapter outlined the concept of SFS and highlighted the vital role dietetic professionals play in promoting sustainability. This chapter introduced the need for SFS and emphasized the importance of involving dietitians in these efforts. Additionally, this chapter discussed the rationale behind creating the three ICDA learning modules and the justification for conducting this research.

The next chapter, the literature review, will focus on exploring the role dietitians play in contributing to a SFS and addressing the current lack of training and knowledge in this area.

# Chapter 2: Literature Review

## Chapter Outline

This chapter discusses the works of previous scholars on Sustainable Food Systems (SFS). It also talks about the importance, benefits and complexities of having a SFS. The role of dietitians in promoting sustainable diets and food systems, barriers dietitians face in incorporating SFS into practice, and dietetic professional perspectives and challenges in integrating SFS into practice will also be discussed.

## 2.1 The Importance of Sustainable Food Systems

While our current food system excels in terms of efficient food distribution networks, faster food production, global trade, and employment opportunities, however, it still falls short in the area of sustainability (Holden et al., 2018). This lack of sustainability is evident in the numerous issues it generates, including food waste, poverty, limited food access, resource depletion, soil degradation, global warming, and biodiversity loss (Holden et al., 2018; Zinsius, 2013). All these factors make our current food system unsustainable, highlighting the need to have a system that prioritizes environmental health, ensures access to quality food for all humans, and reduces food waste.

A SFS aims to ensure universal access to safe, affordable, nutritious, and culturally appropriate food for all individuals worldwide; it endeavors to meet the needs of the present without jeopardizing future needs (Lindgren et al., 2018). A SFS also addresses concerns regarding inadequate food access by reducing the number of individuals without sufficient nutritious food (The Nutrition Source, 2015).

A SFS is not only a necessity but also offers significant benefits, including environmental protection through reduced deforestation and minimized environmental impact from livestock

grazing (Holden et al., 2018). It fosters economic stability while enhancing the nutritional health of the population (Johnson et al., 2014). It also prioritizes resource preservation for future generations and emphasizes the importance of sustainable agriculture practices, efficient distribution systems, fair trade, and inclusive policies to create a food system that supports human well-being and health along with the health of the planet (Johnson et al., 2014).

### 2.2 Complexities of Sustainable Food Systems

Sustainable food systems are crucial but highly complex. This complexity is due to the multitude of factors that influence them, the interconnected nature of these factors, and the trade-offs or imbalances that may arise from prioritizing one factor over the other (Garnett et al., 2016). This is why what constitutes a SFS can vary widely based on factors such as environment, culture, and economy (Garnett et al., 2016).

In a 2017 research paper by Gammage, it was noted that food systems do not exist in isolation; rather, the factors influencing these systems are influenced by external factors as well as each other. For example, weather conditions (external factors) can affect crop yields, which in turn may influence food prices and availability. This can lead to increased food prices and subsequently affect consumers' dietary choices. This interconnectedness makes it challenging to quantify the impacts of individual factors on the system, as changes in one aspect can ripple throughout the entire system. Gammage suggests that achieving a SFS requires a delicate balance of these various causes and effects (Gammage, 2017).

The concept of sustainability takes on different meanings in low-income and high-income countries. In low-income countries, achieving a SFS entails ensuring sufficient food availability to meet the needs of the entire population and alleviate food insecurity, malnutrition, and

nutritional deficiencies (Garnett et al., 2016). The emphasis in these regions often lies in increasing meat, dairy, fruit, and vegetable consumption and enhancing agricultural inputs (Clark et al., 2020). In contrast, in high-income countries, the focus of sustainability shifts to increasing fruit and vegetable consumption while reducing meat and dairy intake and combating nutrition-related diseases such as obesity and cardiovascular disease, which are prevalent in these nations (Fanzo, 2019).

Another layer of complexity in sustainable food systems arises from the need to balance different priorities that often conflict with one another. For instance, cultural and social norms can shape dietary patterns in ways that may not align with environmental sustainability goals. For example, in many cultures, meat holds significant cultural value, and reducing its consumption can be challenging due to deeply rooted social traditions and norms (de Boer et al., 2017). However, from an environmental perspective, animal-based diets tend to impose a greater environmental burden than plant-based diets due to higher greenhouse gas emissions, greater land use, and higher water consumption (Springmann et al., 2016). This interplay between cultural importance and environmental impact adds to the complexity of creating a SFS.

Economic factors such as income and the affordability of nutritious foods also exert a significant influence on sustainable diets. Limited access to healthy foods among low-income individuals can lead to less sustainable dietary practices (Swinburn et al., 2019).

Furthermore, environmental factors such as climate change, land use, and water availability also add complexity (Langley et al., 2021).

A 2016 paper by Garnett and colleagues further illustrates the complexity of a SFS. Garnett et al (2016) noted that while reducing greenhouse gas emissions is a primary goal of a SFS, it is not

enough to promote foods with lower emissions solely; the health aspect must also be considered. For example, sugar has lower greenhouse gas emissions compared to fruits and vegetables but lacks health benefits. Therefore, despite their higher emissions, fruits and vegetables should still be prioritized over sugar due to the health benefits they offer. This example highlights the broader reality that healthy foods do not always have a lower environmental impact than unhealthy ones. As Gamage (2017) notes, striking a balance between minimizing environmental impact and ensuring nutritional value is essential. Despite all these challenges and complexity, the positive effects and benefits of SFS make them a valuable choice.

### 2.3 Benefits of a Sustainable Food System

One key advantage of having a sustainable food system is the increased availability and affordability of fruits and vegetables (Lindgren et al., 2018). These nutritious foods are vital for maintaining a healthy diet and reducing the risk of diet-related diseases, including heart disease, stroke, and cancer (Garnett & Finch, 2018). By promoting plant-based diets, a SFS can contribute to a decrease in the consumption of red and processed meat, which are associated with an increased risk of non-communicable diseases (Garnett & Finch, 2018).

Furthermore, food safety is prioritized in SFS by reducing the use of antibiotics in animal agriculture and improving food processing and distribution practices, thus minimizing the risk of foodborne illnesses (Garnett & Finch, 2018). Additionally, these systems aim to minimize exposure to harmful chemicals used in agriculture, safeguarding human health from potential negative impacts (Garnett & Finch, 2018).

Another important aspect of a SFS is its ability to support local economies and communities. By promoting local food production and consumption, these systems enhance social connections,

strengthen community ties, and contribute to improved mental health and well-being (Garnett & Finch, 2018).

While the benefits of SFS are significant, it is important to acknowledge that they also come with challenges and potential downsides. For instance, transitioning to more sustainable practices may incur additional costs for farmers and producers, which could affect the affordability of foods (Guzmán et al., 2011). Additionally, there may be resistance to dietary changes from cultural and social norms, which could impact the effectiveness of sustainability initiatives (Garnett et al., 2016).

Despite these challenges, the potential health advantages of SFS make them a crucial area of focus for nutrition and dietetics professionals. Sustainable food systems align with the goals of improving dietary quality and highlight public health initiatives by promoting increased consumption of plant-based foods and reducing reliance on processed meats (Garnett & Finch, 2018). By noting this complexity yet working towards achieving a SFS, nutrition and dietetics professionals can play a pivotal role in advancing sustainable food practices and improving health outcomes for the population.

### 2.4 The Role of Dietitians in Promoting Sustainable Diets and Food Systems

Dietetic professionals, also known as dietitians, are vital healthcare professionals accredited to provide expert advice on nutrition. They play a crucial role in shaping food systems by promoting healthy eating habits, ensuring individuals receive optimal nutrition for their overall well-being, and promoting SFS within their various practices (Spiker, Reinhardt, et al., 2020). They can be found working in diverse settings such as hospitals, nursing homes, clinics, research institutions, private practice, and more (Spiker, Reinhardt, et al., 2020). Within clinical settings,

dietitians deliver specialized nutrition care and guidance to individuals with a wide range of health conditions. This involves assessing patients' nutritional needs, devising personalized nutrition plans, and monitoring their progress (Spiker, Knoblock, et al., 2020). Additionally, dietitians work in public health contexts, such as health departments and community organizations, where they focus on promoting healthy eating habits and preventing chronic diseases through education, policy development, and community outreach initiatives (Spiker, Knoblock-Hahn, et al., 2020). Moreover, dietitians contribute significantly to the food service industry by ensuring that the food provided in hospitals, schools, and restaurants is safe, nutritious, and aligns with consumers' dietary requirements (Dietitians of Canada, 2021).

Depending on their work environment, dietetic professionals can fulfill different roles in incorporating SFS into their practice. For instance, those working in food service settings such as hospitals, schools, restaurants, and workplace food services can integrate SFS principles into their operations during menu planning and food procurement (Spiker, Reinhardt, et al., 2020). This may involve incorporating more fruits, vegetables, and locally sourced seasonal items (Spiker, Reinhardt, et al., 2020).

Similarly, dietitians in clinical settings can advocate for and encourage their workplaces to adopt sustainable food practices. They can also refer their clients to various resources and community initiatives focused on sustainable practices (Spiker, Reinhardt, et al., 2020). In corporate settings, dietetic professionals can leverage their influence to encourage their workplaces to adopt sustainable practices, such as reducing packaging materials and opting for sustainable packaging options (Spiker, Reinhardt, et al., 2020).

Moreover, dietitians can educate their clients, the public, the institutions in which they work, and government agencies about the environmental impact of food choices, empowering individuals

and organizations to make more sustainable decisions (Dietitians of Canada, 2020). This can involve promoting plant-based diets, reducing food waste, and supporting local food systems (Spiker, Reinhardt, et al., 2020). Furthermore, dietitians can advocate for policy changes at various levels, aligning with organizations actively supporting SFS policies, such as reducing food waste and enhancing access to healthy and sustainable foods (Carlsson et al., 2020).

Beyond education and advocacy, dietitians significantly contribute to research on nutrition and food-related issues. Operating in various research settings, including universities and private research organizations, they often collaborate with the food industry to develop and promote nutritious and sustainable food products (Dietitians of Canada, 2023). This multifaceted involvement enables dietitians to bridge the gap between research and practice, promoting evidence-based, sustainable food choices (Willet et al., 2019).

Dietetic professionals are indispensable in promoting sustainable diets and food systems due to their multifaceted roles across various sectors of the food system and their ability to integrate sustainable practices into their practice effectively (Spiker, Knoblock-Hahn et al., 2020). Given their extensive involvement across various sectors of the food system, dietitians possess the knowledge and expertise to promote SFS effectively.

### 2.5 Dietetic Professional Perspectives and Challenges in Integrating SFS into Practice

Several research studies over the past decade in the United States have explored dietetic professionals' perspectives on integrating SFS into their practice. Across these studies, there is a common recognition of the importance of SFS in dietetics, but also significant gaps in knowledge, confidence, and application. Understanding these perspectives is crucial for

identifying areas where dietitians need more support and training to effectively incorporate sustainability into their work.

A 2011 study by Harmon and colleagues surveyed 145 dietetic educators in the United States to assess their attitudes toward teaching SFS. The survey revealed that 82% of the respondents believed it was their duty to educate their students about SFS. Despite this strong sense of responsibility, 77% of these educators reported that their students showed little interest in SFS. Additionally, 77% expressed the need for better resources to help them integrate SFS into their curriculum. However, only a little more than half of the educators felt confident in their own understanding of SFS (52%) or in their ability to teach it effectively (42%). This study highlights a critical gap: while there is recognition of the importance of SFS, there is a lack of confidence and sufficient educational resources to teach it effectively. Although conducted in 2011, the findings underscore a continuing need for enhanced education and training in SFS for dietetic professionals across all domains—whether in education, research, private practice, or clinical settings (Harmon, 2011).

Building on these findings, a 2015 cross-sectional study by Hawkins and colleagues in the US explored the perspectives of 570 registered dietitians on environmental issues related to SFS. The study found that 75% of the dietitians considered climate change and environmental sustainability crucial to maintaining a SFS. This reflects a strong awareness among dietitians of the broader environmental context in which food systems operate. However, the study also emphasized the need to empower dietitians by enhancing their knowledge, skills, and self-efficacy concerning environmental issues. This demonstrates that while dietitians are aware of the importance of sustainability, there is still a need to build their competence in these areas to

ensure they can effectively incorporate these considerations into their practice (Hawkin et al., 2015).

Further illustrating the gap between awareness and application, a 2017 cross-sectional study by Heidelberger and colleagues surveyed 626 registered dietitians and found that although 89% had heard of SFS, only 47% were actively integrating these principles into their practice. This discrepancy suggests that while knowledge of SFS is widespread, there is a significant challenge in translating this knowledge into practical action (Heidelberger et al., 2017).

In conclusion, these studies highlight the perspectives of dietetic professionals about SFS and some challenges they face in integrating SFS into their practice. While there is a clear recognition of the importance of sustainability among dietitians, there remain substantial barriers related to knowledge, confidence, and practical application. Addressing these barriers and gaps through targeted education and professional development courses will be essential for advancing the role of dietitians in promoting SFS.

### 2.6 Barriers Dietitians Face in Incorporating SFS into Practice

The previous section provided an overview of the challenges faced by dietetic professionals in incorporating SFS into their practice. This section, however, will delve more into the specific barriers that hinder dietetic professionals from effectively integrating SFS principles into their work. By exploring these barriers in depth, this section aims to provide a clearer understanding of the factors that limit the application of sustainable food systems in dietetic.

Guillaumie and colleagues (2020) conducted a mixed-methods systematic review, which identified 25 factors and barriers that affect the implementation of SFS in professional dietetic practices. The study found that years of professional experience played a significant role, with

dietitians who had more years of practice being less aware of environmental issues. Professional knowledge also emerged as a key factor, as dietitians who were more knowledgeable about SFS were better able to incorporate it into their practice.

Perceived skills and self-efficacy influenced the integration of SFS, with participants who perceived themselves as lacking skills being less likely to include SFS in their work. The authors highlighted the importance of increasing dietitians' skills in SFS. Additionally, access to evidence-based facts and information tools was critical; a lack of access to such resources hindered dietitians from incorporating SFS effectively.

Time constraints were another significant barrier, as dietitians reported that limited time for training and application prevented them from integrating SFS into their practice. Support from managers, institutions, and colleagues was also essential, as a lack of encouragement negatively impacted dietitians' efforts to include SFS in their work. On the other hand, involvement in networks that promoted SFS enhanced dietitians' ability to apply these principles in practice.

The complexity of SFS as a topic further influenced its integration. Dietitians often focused on simpler aspects, such as encouraging clients to shop local or eat organic, while avoiding more complex issues like reducing food waste or choosing culturally acceptable foods with less packaging. This tendency underscored the need for targeted education and support to help dietitians address more intricate aspects of SFS in their practice.

A 2022 research paper by Carlsson and Callaghan explored the barriers that nutrition and dietetic professionals (NDPs) from 30 nations, including Australia and Canada, face in incorporating SFS into their practice. The survey results revealed several key barriers. One significant finding was the complexity of SFS. Participants from the study noted that the issues surrounding SFS are

highly complex, and the extent of changes needed can feel overwhelming. This often resulted in NDPs experiencing a sense of helplessness and confusion about which actions to take.

Professional culture within the dietetics community also posed a challenge. There is a lack of consensus regarding the extent to which SFS falls within the scope of practice, and some managers and peers are reluctant to support sustainability-related research and practice. This cultural hesitation creates a barrier to progress. Additionally, the "food price paradox" emerged as a notable challenge. Food prices are perceived as both too high and too low; many people cannot afford nutritious food due to economic constraints, while government subsidies make ultra-processed foods artificially cheap, discouraging healthy eating and undervaluing food-related professions.

Another barrier was the prioritization of profits within the food industry. The industry's focus on profit, along with related policies, often overshadows social and environmental concerns, making it difficult for NDPs to address health issues stemming from this profit-driven approach. The trade-offs between food safety and waste also presented challenges. Regulations aimed at ensuring food safety can lead to significant food waste. For example, best-before dates and policies preventing the reuse or donation of unused food in institutions contribute to environmental and ethical concerns about waste.

Access to infrastructure and technology varied by region and posed distinct challenges. In industrialized countries, there is a strong focus on convenience and low-cost food, supporting a capitalist system that deprioritizes sustainability. In less industrialized regions, barriers such as inadequate infrastructure, limited technology, and lack of knowledge hinder sustainable farming practices and food storage. Lastly, the survey highlighted the impact of environmental degradation. Global food systems contribute to issues like pollution, climate change, and

deforestation, which in turn affect the capacity for sustainable food production and indirectly impact the work of NDPs in promoting human health.

The International Confederation of Dietetic Association (ICDA) created three online learning modules to address some of the barriers faced by dietetic professionals in incorporating SFS into their practice. One of the primary goals of these modules is to enhance professional knowledge. By providing up-to-date, evidence-based information on SFS, the modules help close knowledge gaps and build a solid foundation, enabling dietetic professionals to integrate SFS principles into their work effectively. There are three learning modules: the first addresses the foundational concepts of SFS, the second explores the relevance of SFS to nutrition, and the third focuses on how dietitians can contribute to SFS in their practice.

Another focus of the ICDA modules is building skills and self-efficacy. Utilizing tools such as case studies, workshops, and practical examples, these modules are designed to increase dietitians' confidence and competence in applying SFS concepts in their practice. Additionally, the ICDA recognized the time constraints that dietitians often face. To accommodate this, the modules are online and self-paced, offering flexibility that allows professionals to engage with the content at their convenience. This flexibility supports continuous learning and professional development without imposing an undue burden on busy professionals.

The modules also facilitate resource access by providing a range of tools, including toolkits, case studies, and best practice examples, which dietetic professionals can use to inform their practice and decision-making. Another essential aspect of the ICDA initiative is encouraging networking and collaboration. The ICDA website promotes networking opportunities through platforms like WhatsApp and LinkedIn, enabling dietitians to connect, share experiences, and learn from peers worldwide, thereby building a supportive community focused on SFS.

Lastly, the ICDA modules promote advocacy and organizational support. They include content on advocacy strategies that help dietitians push for policy and organizational changes that support sustainable food systems. By addressing these barriers through a combination of knowledge enhancement, practical tools, flexible learning options, and advocacy support, the ICDA learning modules aim to provide a comprehensive approach to increase the capacity of dietetic professionals to integrate SFS into their practice.

### 2.7 Comparative Studies and Insights in Dietetic Education in SFS

Two studies have explored how online learning and curriculum integration can enhance dietetic education, particularly in fostering SFS thinking. These studies are closely related to this thesis, which seeks to evaluate the effectiveness of the ICDA online training methods in building confidence and competence among dietetic professionals.

A notable study by Spiker and colleagues (2021) piloted two interactive online webinar series among dietetic interns and graduate students from four US universities. The research aimed to assess how online learning can foster systems thinking and its application in dietetic practice. The webinar series, which included a training webinar, a practice activity, and a synthesis webinar, engaged 140 participants. Participants watched pre-recorded video lectures and completed case studies and other interactive activities in groups through online breakout rooms. Post-test results revealed increased confidence across all learning outcomes, which was attributed to factors such as practice activities, peer interaction, expert consultation, and the synthesis webinar. This study highlights the benefits of online learning, such as fostering collaboration across geographic regions and providing easier access to experts from various disciplines. It also demonstrates how structured activities based on Bloom's taxonomy can enhance higher-order thinking skills. (Spiker et al., 2021).

Similarly, Hege and colleagues (2021) conducted a study on integrating a SFS curriculum into nutrition and dietetic education. Their research assessed the early implementation of this curriculum, revealing that participants reported increased confidence in SFS after completing the program. Pre- and post-surveys indicated significant improvements in the ability to identify, integrate, and communicate evidence-based information effectively. However, the study also highlighted barriers, such as time constraints, a lack of knowledge or familiarity with SFS among educators, and the perception that sustainability education should be optional in dietetics.

These studies offer valuable insights that parallel the objectives of my research. Both emphasize the importance of online learning for dietetic professionals in SFS. While Spiker's (2021) study focuses on systems thinking and Hege's (2021) study focuses on curriculum integration, both studies highlight the need for building competence and confidence among dietetic learners—an area my research also seeks to address. Although the ICDA learning modules may not resolve all educational gaps in dietetics, they are designed to contribute significantly to the advancement of sustainable diets and food systems training. This thesis, builds on the insights from these studies, aims to evaluate the impact of an educational intervention (ICDA modules) on dietetic professionals.

### 2.8 Conclusion

Several studies have identified key barriers dietetic professionals face in integrating SFS into their practice, including a lack of knowledge, insufficient confidence, time constraints, and limited employer support. These barriers underline the need for improved training methods to effectively address these gaps.

The ICDA learning modules were specifically designed to address some of these identified barriers. As noted by Wegener (2018), there is a significant need for training methods that enhance dietitians' ability to integrate SFS into their work. Current training often lacks sufficient emphasis on SFS, leaving dietitians unprepared for effective integration (Wegener, 2018). The ICDA modules aim to fill this gap by providing comprehensive online learning opportunities that dietitians can complete at their own pace. This flexibility is intended to overcome time constraints and provide dietitians with the knowledge and confidence needed to apply SFS principles in various settings.

Similarly, the 2017 cross-sectional study by Heidelberger and colleagues referenced previously identified knowledge, time, and employer support as essential factors in improving SFS integration. The ICDA modules specifically address the knowledge barrier by providing detailed SFS content and allowing dietetic professionals to improve their knowledge at their own pace. These modules also offer a solution to the time constraints that many dietitians face because they are online and self-paced.

Furthermore, Harmon and colleagues (2011) highlighted that while dietetic educators recognize the importance of teaching SFS, many lack confidence in their ability to do so effectively. The ICDA modules were designed with this in mind, incorporating features such as case studies, practical examples, and resources to build both the confidence and competence of dietetic professionals in applying SFS principles.

My research study aims to examine the effectiveness of the ICDA learning modules in overcoming these barriers and enhancing dietetic professionals' confidence and competence in SFS. By conducting surveys and focus groups, my study evaluated how useful the modules are in helping dietitians apply SFS principles in their practice and identify the specific features and

formats that are most beneficial in increasing dietetic professional's confidence and competence in SFS. Additionally, the research will examine areas where the modules may fall short.

The findings from this research will be critical in informing the future development of training programs for dietitians. By identifying which aspects of the ICDA modules are most effective and where improvements are needed, my study can help shape more targeted and effective educational resources that better support dietetic professionals in integrating SFS into their practice.

# Chapter 3: Assessing the Impact of the ICDA Learning Modules on Confidence and Competence in Sustainable Food Systems Among Dietetic Professionals.

**Co-Authorship Statement**

This chapter was written by Phebe Oluwafemi with edits provided by Dr. Rachel Prowse, Dr. Liesel Carlsson, Dr. Olga Heath, and Dr. Atanu Sarkar. Funding for this study was secured by Dr. Liesel Carlsson and Dr. Rachel Prowse. Ethical approval was obtained from Memorial University and Acadia University by Phebe Oluwafemi, Dr. Liesel Carlsson, and Dr. Rachel Prowse. Data collection was carried out by Phebe Oluwafemi, Dr. Liesel Carlsson, and Dr. Rachel Prowse. The survey and focus group questions were designed by Phebe Oluwafemi, Dr. Rachel Prowse, and Dr. Liesel Carlsson, with input from Dr. Olga Heath and Dr. Atanu Sarkar. Data analysis was conducted by Phebe Oluwafemi, with input from Dr. Rachel Prowse and Dr. Liesel Carlsson. This chapter has not been submitted for publication, but submission will be undertaken by Phebe Oluwafemi

### 3.1.1 Introduction

With many problems facing our world, such as food insecurity, climate change, environmental degradation, biodiversity loss, resource depletion and many others, now, more than ever, we need to care about our environment (Holden et al., 2018; Zinsius, 2013). Our global food system contributes about 21 to 37 percent of our total greenhouse gas emissions (Mirzabaev et al., 2023). Food systems include all the processes involved in getting food to our table, from the production, processing, transportation, consumption, and disposal of food (Food and Agriculture Organization of the United Nations (FAO), 2016). Since food and nutrition are important to life, we must evaluate how we process our food. Establishing a Sustainable Food System (SFS) will ensure that everyone has access to safe, nutritious, affordable, good quality, and culturally acceptable food produced in an environmentally conscious way (Lindgren et al., 2018).

Dietetic professionals can be at the forefront of creating a SFS as they are trusted professionals in nutrition and health who are well-positioned to play an important role in shaping the nutrition and health of the population (Dietitians of Canada, 2020). Given their influential role, it is crucial that they possess a thorough understanding of SFS and have the confidence to apply this knowledge in their professional practices. However, dietetic professionals often lack adequate knowledge and training about SFS, limiting their ability to incorporate them into their practice (Guillaumie et al., 2020). Therefore, there is a need for practical training on integrating sustainability into their practice and ways of effectively communicating the environmental impact of food choices to their clients (Spiker et al., 2020).

To address this gap in the knowledge and training of dietetic professionals, the International Confederation of Dietetic Associations (ICDA) developed three comprehensive online learning modules. These modules provide guided learning resources on SFS, aiming to equip dietetic

professionals with the necessary knowledge, skills, and confidence to integrate them into their professional practices. The ICDA learning modules cover various topics that expand dietetic professionals' knowledge of SFS. The ICDA learning modules aim to teach dietetic professionals how SFS is relevant to their profession, the potential roles they can play in fostering sustainability, and actionable steps to incorporate sustainable practices into their work. Furthermore, the modules aim to boost dietetic professionals' confidence in incorporating SFS into their various practices.

Research Objective

This study seeks to assess the effectiveness of the ICDA online learning modules in enhancing dietetic professionals' confidence and competence in applying sustainable food systems to their practice.

Research question

How, if at all, do the ICDA online learning modules increase dietetic professionals' self-reported confidence and competence in sustainable food systems?

This chapter will evaluate whether participants' self-reported confidence and competence increased after going through the modules.

### 3.1.2 Definitions

To ensure clarity, through this paper, the following key terms are defined:

- Competence: In this study, competence is defined as having a thorough understanding of the ideas, theories, and best practices associated with sustainable food systems and the ability to apply them effectively in practical situations (Hooper et al., 2014).

- Confidence: Confidence refers to dietetic professionals' self-assurance and trust in their ability to successfully integrate sustainable food systems into their practice (Budin, 2017).
- Readiness: Readiness refers to the preparedness and willingness to incorporate sustainable food systems into professional practice (Lena et al., 2023).

### 3.2 Methods

A mixed-method research approach was used for this study. A mixed-methods approach utilizes both quantitative and qualitative research methods (Shorten & Smith, 2017). Specifically, a concurrent design was chosen where the qualitative and quantitative data were collected and analyzed in a similar time frame (Fetters et al., 2013). In this design, the qualitative and quantitative data were analyzed separately and then merged (Fetters et al., 2013). This approach allows for the quantitative and qualitative data to be integrated seamlessly and increases the robustness and depth of the findings (Fetters et al., 2013). Merging the data from the surveys and focus groups strengthened the data analysis by providing a more comprehensive understanding of the participants' experiences.

The Health Research Ethics Authority at Memorial University of Newfoundland (HREA-20240045) and the Research Ethics Board at the University of Acadia (REB 23-24) provided ethical approval, ensuring this study follows the ethical norms for human-participant research.

#### 3.2.1 Participants and Sampling

Eligible participants were registered dietetic professionals aged 18 years and older with at least one year of professional experience. These criteria ensured that participants had some experience working in their field.

This study included two groups of participants: one from Australia (n = 10) and one from Canada (n = 15). Australia and Canada were chosen for this study as they had similar dietetic education frameworks, which allowed us to analyze the data together. These two countries were also chosen because of the ease of recruiting dietetic professionals. All participants were registered dietitians or nutrition, and dietetic professionals recognized by their respective regulatory bodies.

Recruitment strategies varied between the two countries. In Canada, recruitment focused on Dietitians of Canada (DC) members, utilizing the DC Sustainable Food Systems Network internal communication functions, email distribution lists, and outreach to dietitians across provinces. Recruitment efforts in Australia included posting advertisements at SFS conferences and email lists targeting Australian dietetic professionals.

Overall, the study successfully recruited 25 participants (15 from Canada and 10 from Australia). However, 5 participants (4 Canadians and 1 Australian) dropped out during the second and third focus groups. All 25 participants completed the baseline survey, but only 20 (11 Canadians and 9 Australians) participated in the three-month follow-up survey. Focus group data was collected and analyzed for all 25 participants, including those who later withdrew. However, only the survey data from participants who completed the three-month follow-up (n=20) was analyzed. A visual timeline of the survey and focus group can be found in Appendix I.

Appendices II and III provide recruitment infographics and advertisements used during the study. All participants received a $30 honorarium for their participation, as well as an additional $70 honorarium after completing the three-month follow-up survey.

### 3.3 Data Collection and Analysis

#### 3.3.1 Focus Group Administration

The researchers moderated the focus group meetings on Cisco Webex. Participants were divided into two groups. In total, there were six focus group meetings, three for Australians and three for Canadians. Each focus group session focused on a specific ICDA learning module. The first focus group meeting discussed the first module, the second addressed the second module, and the third focused on the third module. Each focus group ran from 50 to 80 minutes. The questions posed during the three focus group meetings are listed in Appendices IV to VI.

The baseline survey for this research study was conducted first in September 2023. Following the baseline survey, participants completed the learning modules before attending the focus group meetings. Each focus group was scheduled after the completion of its respective module: Focus group meeting 1 was held after participants completed learning module 1, focus group meeting 2 was conducted after learning module 2, and focus group meeting 3 followed the completion of learning module 3. These focus groups were held between October and December 2023. The three-month follow-up survey was conducted in April 2024. The focus group data was analyzed from January – March 2024 using Braun & Clarke's (2006) thematic analysis methods. The result from this focus group guided the questions for the three-month follow-up survey. The baseline and three-month follow-up surveys were analyzed in May and June 2024

#### 3.3.2 Survey Design and Administration

The data collection involved two surveys: a baseline survey conducted before participants accessed the ICDA learning modules and participated in the focus group meeting as well as a

three-month follow-up survey administered three months after the final focus group meeting. Both surveys were administered using the Acadia University Survey platform, LimeSurvey.

The baseline survey consisted of eight questions, including three Likert scale questions measuring knowledge, readiness, and confidence. These same questions were repeated in the three-month survey, with three additional open-ended questions. These new questions were designed to capture the depth of knowledge gained during the focus groups and to gather more detailed feedback on participants' readiness, confidence, and suggestions for improving the ICDA website. The surveys are listed in Appendices VII and VIII.

### 3.3.3 Measurement of Competence, Readiness, and Confidence

Competence was assessed through participants' self-reported knowledge across four critical areas. Participants were asked to self-rate their knowledge of food systems, sustainable diets, and social sustainability, and environmental sustainability. These four areas were chosen because they represent foundational concepts in SFS. These self-reported ratings were interpreted as indicators of competence based on the Dreyfus model, which suggests that competence increases with knowledge (Peña, 2010).

A three-level knowledge scale was created to assess the knowledge of dietetic professionals. This scale aligns with research findings that guided the development of the modules (Carlsson and Callaghan, 2022) and ensured consistency with the original module design. The three levels are:

- Level 1: " I am new to this topic (I want to know more background information about this concept/topic area)."
- Level 2: " I have a good working knowledge of these concepts/topics (I want to understand the relevance of this topic area to my practice)."

- Level 3: " I have a good understanding of the concepts/topics and their relevance to my practice (I want to know more about how to implement this topic area into my practice).
- Option 4: "I do not know"

Confidence in this research study was assessed through participant's self-reported readiness and confidence. Readiness is a construct related to the capacity of healthcare professionals to function effectively in their roles (Lena et al., 2023). Confidence and readiness are linked, as greater confidence in one's abilities is associated with a higher readiness to integrate sustainable food systems into practice (Nastasia et al., 2022).

To measure readiness, the stages of change theory was used (Raihan & Cogburn, 2023). The stages of change theory propose that individuals move through a series of stages when modifying their behaviour (Raihan & Cogburn, 2023). The stages are pre-contemplation, contemplation, preparation, action, maintenance, and full integration (Raihan & Cogburn, 2023).

Using the stages of change theory is appropriate because it provides a structured framework to understand and measure participants' progress in adopting SFS in their practice. This theory allows us to capture the changes in participant readiness to incorporate SFS into their practice.

A six-level scale was created based on the stages of change to measure dietetic professional's readiness.

- Level 1: "I am not even thinking about it" (pre-contemplation stage).
- Level 2: "I have been thinking about it but do not know where to start" (contemplation stage).

- Level 3: "I have been thinking about it and am actively gathering resources and planning" (preparation stage).
- Level 4: "I recently started testing out *sustainable food system* principles in my practice" (action stage).
- Level 5: "I actively and regularly apply *sustainable food system* principles in my practice" (maintenance stage).
- Level 6: "I have embedded *sustainable food system* principles in most or all aspects of my practice" (full integration).

To measure confidence, an ascending five-point scale was used. This scale allowed us to assess changes in participants' confidence over time.

- Level 1: "Not confident at all."
- Level 2: "Somewhat confident."
- Level 3: "Moderately confident."
- Level 4: "Very confident."
- Level 5: "Extremely confident."

### 3.3.4 Data Analysis

The focus group discussions were transcribed non-verbatim and analyzed thematically using the Braun and Clarke (2006) method—this involved coding, categorizing, and identifying themes to answer the research questions. Transcribed discussions were evaluated with codes assigned to parts reflecting key ideas and concepts (Braun and Clarke, 2006). These codes were then

categorized based on participants' experiences with the online learning modules (Braun & Clarke, 2006). The researcher studied the coded data to detect patterns, links and then the researcher developed themes (Braun & Clarke, 2006). The themes developed in the focus group sessions were compared to determine the parallels, differences, and potential inconsistencies in participants' responses (Braun & Clarke, 2006). Direct quotes from the transcripts were then used to back up the findings and provide context. Coding was conducted using NVivo version 14, with codes cleaned and a codebook developed to ensure consistency in the analysis of Australian and Canadian data.

The closed-ended survey questions were analyzed using Excel, where each response option was assigned a percentage. The results were visually represented using bar graphs, allowing us to compare the baseline and three-month responses and identify any changes over time.

The open-ended survey responses were thematically analyzed similarly to the focus group, using the approach outlined by Braun and Clarke (2006).

### 3.4 Rigour and Validity

In this study, several strategies have been employed to enhance rigour, thereby strengthening the overall quality and trustworthiness of the research (Leung, 2015). The rigour and validity of the focus group analysis were enhanced through methodological coherence, ensuring that all the research study components are aligned, connected, and consistent (Poucher et al., 2019). Additionally, strategies that were used are described below.

Study Design Selection: To ensure rigour and validity, a key strategy was carefully selecting an appropriate study design. This research employed a descriptive-qualitative approach, which enabled an in-depth exploration of participants' perspectives and experiences with the online

learning modules (Doyle et al., 2020). This design was chosen for its ability to capture rich, detailed data, providing valuable insights into the content and design features of the learning modules (Johnson et al., 2020).

Thematic Analysis Methodology: Thematic analysis was used as the primary method for analyzing the data collected from the focus group discussions. This well-established qualitative research method allowed for systematically identifying patterns, themes, and connections within the data (Braun & Clarke, 2006). By coding and analyzing the transcripts, researchers could uncover the underlying meanings and interpretations of participants' experiences with the online learning modules (Braun & Clarke, 2006).

Memoing: Memoing was employed throughout the research process to further enhance analytical rigour. This practice involved recording reflective notes on the data, facilitating a deeper understanding and interpretation of the findings. Memoing helped ensure that the analysis remained grounded in the participants' perspectives (Birks et al., 2008).

Diverse Comments**:** The thematic analysis included positive and negative comments from participants regarding the ICDA learning modules. This comprehensive approach contributed to a more nuanced understanding of participants' experiences, thereby enhancing the credibility of the findings (Birt et al., 2016).

Immersion in the Data: Immersion in the data is a crucial aspect of ensuring rigour and validity. Researchers immerse themselves in the data by repeatedly reading and familiarizing themselves with it, which is a key component of thematic analysis (Braun & Clarke, 2006). In this study, the researcher immersed herself in the data by not only repeatedly reading the transcriptions but also creating a code book. This process helped the researcher gain a deep understanding of the

participants' perspectives and responses, facilitating more accurate analysis and interpretation of the data.

Transparency and Documentation: Ensuring transparency and comprehensive documentation throughout the research process is crucial for maintaining rigour and validity (Johnson et al., 2020). This study involved meticulous recording of every aspect of the research, from data collection to analysis and interpretation. Such detailed documentation enhances the study's credibility and allows other researchers to replicate the research process, reinforcing the findings' reliability (Braun & Clarke, 2006).

Member Checking: To validate the research findings, member checking was employed, where participants were asked to provide feedback on the preliminary results (Birt et al., 2016). At the beginning of each new focus group session, the main findings from previous sessions were presented to participants to verify their accuracy and completeness. This technique not only confirmed the validity of the findings but also highlighted areas needing further exploration or clarification.

By implementing these strategies, this study ensured a rigorous and methodologically coherent approach to analyzing the focus group data, thereby enhancing the validity and trustworthiness of the findings (Leung, 2015).

In particular, the two methods listed below were used for the survey to establish rigour and validity in the baseline and three-month surveys.

Ethics Consideration: Participants were provided with a copy of the consent form before both the baseline and three-month surveys. This ensured they were fully informed about the study's purpose and procedures. Participants' consent was obtained transparently, which supported the

credibility of this research findings (Grant & Khatua, 2024). To protect participants' confidentiality, their names were collected solely for tracking purposes but were not used in the results section. During data analysis, participants were assigned a number to ensure that individuals could not be identified. Only the research team had access to the names, and strict confidentiality was maintained throughout the study.

Survey Adjustments: To improve the survey's rigour and validity, the survey questions were carefully selected for clarity and relevance to the research objectives. Each question was designed to align with the study's goals, ensuring they addressed the research question directly. Additionally, after the analysis of the focus group data, the three-month follow-up survey was modified to gather more comprehensive and targeted information. This adjustment allowed the survey to better capture relevant findings and address the research questions more effectively.

### 3.5 Results

The results of this research study are categorized into two outcomes: increased competence and increased confidence.

#### 3.5.1 Increased Competence

The outcome of increased competence examined whether participants' understanding of sustainable food systems principles improved after engaging with the ICDA learning modules.

Food systems and sustainable diets

The first sub-outcome, food systems and sustainable diets will analyze whether participants' self-reported competence in food systems and sustainable diets increased after going through the learning modules.

*Food systems (quantitative result)*

At baseline, 60% (12/20) of participants reported having the highest knowledge level, 20% (4/20) were in the middle knowledge level, and 20% (4/20) were at the lowest knowledge level, with no participants selecting the "I do not know" option.

Three months after completing the modules, the results show an improvement in participants' perceived knowledge. The percentage of participants at the highest knowledge level increased to 80% (16/20), while those at the middle and lowest knowledge levels decreased to 10% (2/20) each. Again, no participants chose the "I do not know" option.

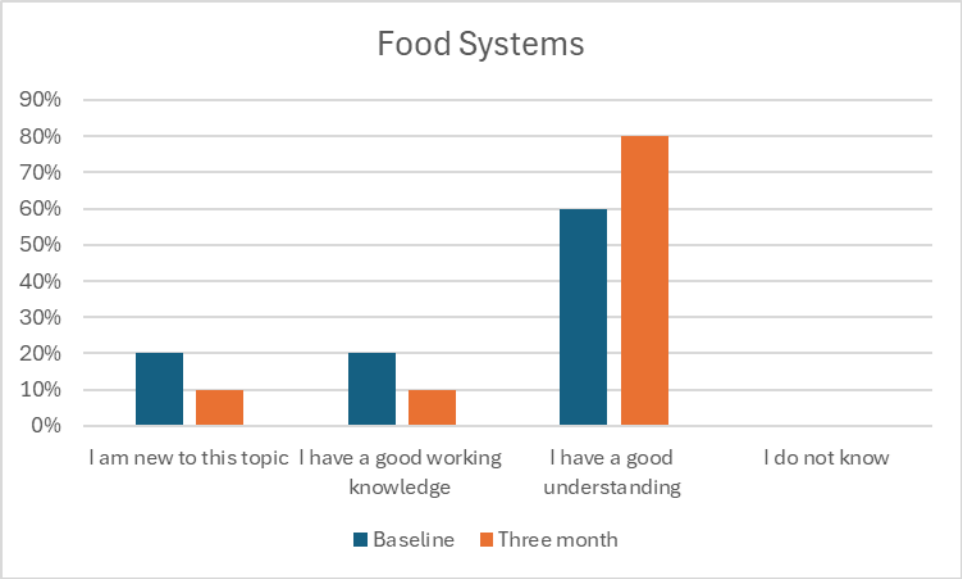


*Figure 1. Participants' baseline vs. three-month self-reported knowledge of food systems.*

In general, the three-month survey indicates a positive shift in participants' knowledge of food systems, with an increase in those at the highest knowledge level and a reduction in those at the lower knowledge levels. The data suggests that the learning modules improved participants' overall food systems competence.

*Sustainable diet (quantitative result)*

At baseline, 50% (10/20) of participants reported having the highest knowledge level, 30% (6/20) were in the middle knowledge level, and 20% (4/20) were at the lowest knowledge level, with no participants selecting the "I do not know" option.

Three months after completing the modules, the results in figure 2 show an improvement in participants' perceived knowledge. The percentage of participants at the highest knowledge level increased to 85% (17/20), while those at the middle and lowest levels decreased to 5% (1/20) and 10% (2/20), respectively. Again, no participants chose the "I do not know" option.

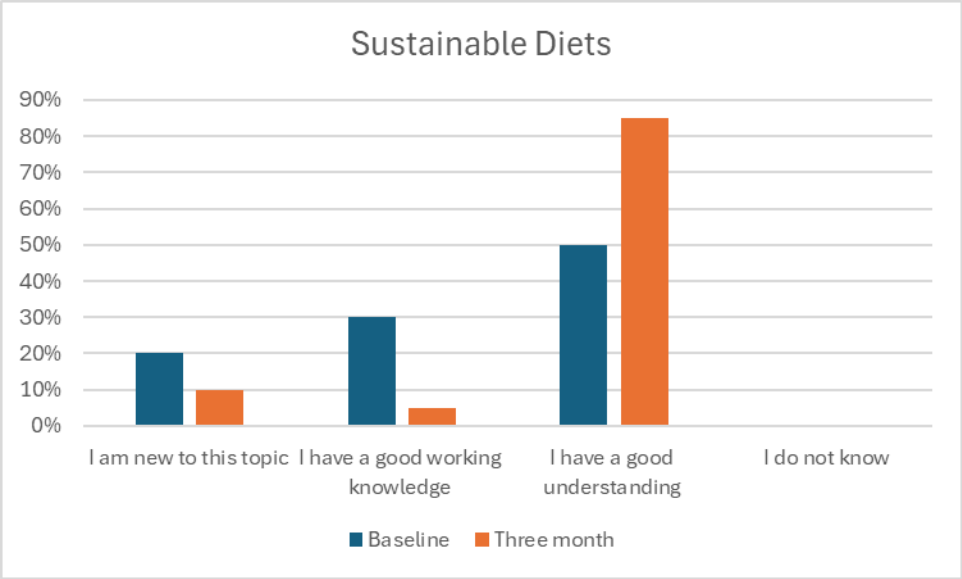


*Figure 2. Participants' baseline vs. three-month self-reported knowledge of sustainable diets.*

After completing the modules, the three-month survey results showed a 20% increase in participants reaching the highest knowledge level for food systems and a 35% increase for sustainable diets, compared to the baseline survey. This suggests that the learning modules likely enhanced participants' knowledge and, thereby, competence in these two areas. Overall, the three-month survey indicates a positive shift in participants' knowledge of sustainable diets, with

an increase in those feeling highly knowledgeable and a reduction in those at lower knowledge levels.

*Focus group and open-ended survey results related to food systems and sustainable diets (qualitative results).*

Participants' understanding of food systems and sustainable diets was evident in the first focus group meeting. This module provided foundational knowledge on food systems, sustainable diets, and sustainable food systems. During the focus group, participants were asked to describe sustainable food systems and diets, and their responses illustrated a clear grasp of various concepts related to food systems and sustainable diets.

For example, one participant defined a *sustainable food system* as *"a way of producing and consuming foods that allow everyone in society the ability to eat a healthy diet and enjoy a healthy life while also ensuring that the planet can continue to provide for future generations"* (P2). This quote shows that after completing the learning module, this participant recognized that a SFS supports environmental sustainability and ensures equitable access to healthy diets for current and future populations. This highlights their understanding of the idea of balancing human and planetary health, a key principle of SFS, as well as temporal aspects critical to complex systems such as food systems.

Another participant mentioned that SFS is *"not taking out more than could be put back. And the example that I found really useful to base that on was in, I think, one of the videos about cutting down trees faster than they can grow. I found that that stuck with me"* (P16). This participant also demonstrates their understanding of the importance of resource conservation, which is an

important concept of SFS. The participant applying a specific example from the module, showed that they retained and understood the module.

A third participant highlighted the complexities of sustainable diets and food systems: *"interconnected processes that affect and have influence over, like, how food is harvested, traded, packaged, transported, and consumed, as well as balancing individual needs and the aspirations of the larger social needs of the collective"* (P15). This participant recognized that SFS are not just about production and consumption but also involve multiple interconnected processes that balance the needs of the individual and the collective.

Another participant emphasized the importance of food and nutrition security in creating a SFS: *"Low environmental impacts and contributing to food and nutrition security and healthy life for present and future generations"* (P12). This quote demonstrates that this participant understood that SFS must address both environmental sustainability and human well-being – the latter being the point of human food systems. This participant also makes the connection between sustainable practices and long-term food security, which is a key learning from the first module

In the three-month survey open-ended questions, one participant stressed the importance of sustainable diets and food systems and the role of dietetic professionals in advocacy: *"I believe sustainable food systems and diets are paramount to the health of humans, and we as dietitians need to be leaders in advocating for sustainability principles to be incorporated into policies, health care food systems, education, etc."* (P14). This participant recognizes how important SFS is, and after going through all three learning modules, they also realize the vital role that dietetic professionals can play in promoting sustainability principles in their practice.

Another participant also noted the instrumental role of the ICDA modules in their learning: *"The ICDA modules support us in developing foundational knowledge on sustainable food systems and sustainable diets"* (P16). This quote confirms that this participant attributes the ICDA learning modules as a helpful tool in teaching dietetic professionals' foundational knowledge on SFS and diets.

The open-ended answers from the focus groups and surveys show that participants understood sustainable diets and food systems. They understood important ideas like food and nutrition security, interconnected processes, and sustainable food systems. They also knew how to put these ideas into practice. Participants further demonstrated their understanding by articulating and applying their knowledge in discussions, illustrating the modules' value in training dietetic professionals on these important topics.

Overall, the survey showed an increase in participants' knowledge level of food systems and sustainable diets. The qualitative analysis also showed that participants were able to demonstrate their understanding of certain principles related to food systems and sustainable diets by articulating and applying their knowledge in the focus group discussion after completing the learning module on that topic. This supports the notion that the learning modules may be effective in enhancing the competence of dietetic professionals in food systems and sustainable diets. This also shows that the modules could be a valuable tool in training dietetic professionals on food systems and sustainable diets.

Social and environmental sustainability

The second sub-outcome, social and environmental sustainability, will examine whether participants' competence in these two sections increased after going through the learning modules.

*Social sustainability (quantitative result)*

At baseline, 20% (4/20) of participants reported having the highest knowledge level, 45% (9/20) were in the middle knowledge level, and 30% (6/20) were at the lowest knowledge level, with 5% choosing the "do not know" option.

Three months after completing the modules, the results in figure 3 show an improvement in participants' perceived knowledge. The percentage of participants at the highest knowledge level increased to 55% (11/20), while those at the middle knowledge levels decreased to 30% (6/20), and those at the lowest knowledge level decreased to 15% (3/20) with no participants chose the "I do not know" option.


*Figure 3. Participants' baseline vs. three-month self-reported knowledge of social sustainability.*

Overall, the three-month survey indicates a positive shift in participants' knowledge of social sustainability, with an increase in those feeling highly knowledgeable and a reduction in those at lower knowledge levels. The data suggests that the learning modules improved participants' competence in social sustainability.

*Environmental sustainability (quantitative result)*

At baseline, 45% (9/20) of participants reported having the highest knowledge level, 35% (7/20) were in the middle knowledge level, and 20% (4/20) were at the lowest knowledge level, with 5% choosing the "do not know" option.

Three months after completing the modules, the results in figure 4 show an improvement in participants' perceived knowledge. The percentage of participants at the highest knowledge level increased to 80% (16/20), while those at the middle knowledge levels decreased to 10% (2/20), and those at the lowest knowledge level decreased to 10% (2/20) with no participants chose the "I do not know" option.

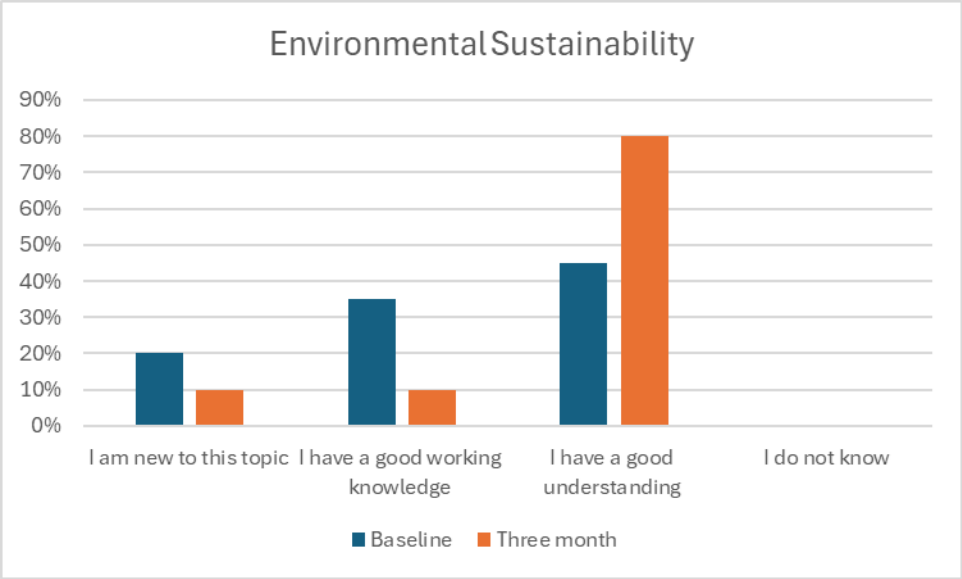


*Figure 4. Participants' baseline vs. three-month self-reported knowledge of environmental sustainability.*

Overall, the three-month survey indicates a positive shift in participants' knowledge of environmental sustainability, with an increase in those feeling highly knowledgeable and a reduction in those at lower knowledge levels.

After completing the modules, the three-month survey results in figure 4 showed a 35% increase in participants with the highest knowledge level for social sustainability, as well as a 35% increase for environmental sustainability compared to the baseline survey. This suggests that the modules enhanced participants' knowledge and, thereby, competence in social and environmental sustainability.

*Focus group and open-ended survey results (qualitative result).*

Initially, participants expressed a lack of focus on social and environmental sustainability in the readings they had done before completing the ICDA learning modules. One participant in the baseline survey highlights a gap in traditional sustainability discourse, noting that it often focuses on the ecological aspect without addressing social factors. *"I struggle to get on board with SFS in dietetics and health topics more generally because the discourse, more often than not, narrowly focuses on ecological sustainability without considering social aspects, namely power and privilege, that govern human responses and approaches to the environment. So, I'm curious how this training relates to my experience with SFS in dietetics. I appreciate that ecological and social sustainability were mentioned separately in the first part of this survey"* (P11). This quote demonstrates that this participant has some awareness of social sustainability but saw it as underrepresented in the readings they encountered prior to completing the modules.

In the first focus group, one participant noted that many people, including their colleagues, tend to focus only on environmental sustainability, overlooking the social justice aspect. *"People aren't thinking about the whole picture. They're just thinking about one, so I often tend to switch the way I frame things for people. They tend to think about one aspect of sustainability, this environment, and not include the social justice side as well"* (P3).

Another participant noted, "*After reading all the material in the modules, I found that my previous understanding of sustainable food systems is quite narrow because I'm a person who, when I think about sustainability, is only concerned about the environment. However, we must also consider animal welfare and social justice, food security, a culture-appropriate diet, and nutrition health. There are multiple aspects to consider"* (P4). This participant acknowledged that their prior understanding of sustainability was narrowly focused on environmental issues. The modules helped them broaden their perspective to include not only the environment but also the social aspect. This quote demonstrates how the learning modules encouraged participant understanding of sustainability, which includes both social and environmental factors.

Participants shared how the modules broadened their understanding. One said, *"I learned the aspect of social sustainability"* (P11), while another appreciated the information presented: *"Yes, I liked the "triple bottom line" information, the acknowledgment of economic, social, and environmental sectors"* (P10). The first quote demonstrates how the learning modules were useful in teaching participants about social sustainability. The second quote shows that the participant appreciated how the modules presented sustainability as interconnected, including both the social and environmental aspects.

Participants mentioned that their perspectives changed after going through the modules, with one stating, *"Reading through things brought that back to my focus, and it was a good visual reminder that social and environmental sustainability is very much a vital part of a sustainable food system"* (P17). This participant indicates that the learning modules helped refocus their attention on the importance of both social and environmental sustainability.

Another participant noted that they initially focused mainly on food and the environment but experienced a shift in perspective after completing the module, *"The modules did give me a bit*

*of a shift, and I did like that piece on pulling in the business and the social side of sustainability because, for me, it was kind of easy to ignore. It's like, no, it's just about the food and the environment. But it is important to consider them because they are such big drivers. I think that was kind of the biggest shift in my mind"* (P10). This participant's newfound awareness of the importance of the social aspects in sustainability illustrates how the modules have broadened their view to include social sustainability as an important element.

In the three-month open-ended questions, participants emphasized the importance of social and environmental sustainability and expressed a desire to learn more and incorporate these aspects into their practice. One participant stated, *"It is necessary to have a basic understanding of the wider environmental, economic, and social context in which food systems sit to understand their influences and how change can be affected at different levels"* (P9). This participant also suggested including more social sustainability concepts unique to the Canadian context, such as Indigenous sovereignty and perspectives.

The focus group and surveys showed that while participants initially lacked familiarity with social and environmental sustainability, they grew more knowledgeable after completing the modules. Participants provided comprehensive answers incorporating social and environmental aspects when asked to describe a SFS in later focus group meetings. One participant described it as *"a system that does not overwhelm our environment, social structures, or economic ability to cope"* (P18). This participant recognized that a sustainable system must balance environmental, social, and economic factors without overwhelming any one area. This definition demonstrates an understanding of the interconnections between these factors.

Another participant emphasized the importance of cultural heritage and social aspects in SFS, stating that they give importance to traditional foods and cultures and local food systems (P14).

By emphasizing the importance of traditional foods, cultural heritage, and local food systems, this participant shows that they understood the role social sustainability plays in maintaining a SFS.

One participant mentioned the significance of fair wages in the food system, highlighting that advocacy is needed for fair wages among farm workers in Canada (P13). This participant demonstrates a thorough understanding by connecting social sustainability to real-world issues like fair labor practices in the food system.

In conclusion, the focus group discussions and survey responses indicated that the learning modules increased participants' social and environmental sustainability competence. Initially, participants' understanding was limited, but after interacting with the modules, they demonstrated a more thorough understanding of these concepts as can be seen through the increase in knowledge levels at the three-month focus group. This progress underlines the modules' usefulness in broadening knowledge and increasing competence. However, it is important to note that while knowledge increased, there is still room for improvement, particularly in social sustainability, as only 55% of participants reached the highest knowledge level in this area. Tailoring the modules to address social sustainability better could further enhance participants' understanding.

Overall, the outcome of increased competence showed that participants' knowledge of food systems, sustainable diets, social sustainability, and environmental sustainability improved. Participants were able to demonstrate a thorough understanding of the concepts and factors involved in creating an SFS. They were also able to articulate their understanding, showing that the modules positively impacted their knowledge and competence in SFS.

### 3.5.2 Increased Confidence

The second outcome of increased confidence will examine whether participants' readiness and confidence to incorporate sustainable food systems into practice increased after going through the learning modules.

Readiness

In this first sub-outcome, we will analyze whether participants' readiness to incorporate SFS principles into their dietetic practice increased after going through the learning modules.

*Quantitative result*

There are six levels of readiness, with level 1 being the lowest: "I am not even thinking about it," and level 6 being the highest: "I have embedded *sustainable food system* SFS principles in most or all aspects of my practice." At baseline, 0% (0/20) of participants were at the lowest readiness level; 20% (4/20) were at the second level of readiness, 35% (7/20) were at the third level, 20% (4/20) were at the fourth level, 25% (5/20) were at the fifth level, and 0% (0/20) were at the highest readiness level.

Three months after completing the modules, the results in figure 5 showed an increase in participants' readiness levels. The percentage of participants at the lowest readiness level remained the same at 0% (0/20). The percentage at the second level decreased to 5% (1/20), and those at the third level decreased to 25% (5/20). The percentage of participants at the fourth level remained the same at 20% (4/20), while those at the fifth level increased to 45% (9/20). Additionally, 5% (1/20) of participants had reached the highest level of readiness by three months.

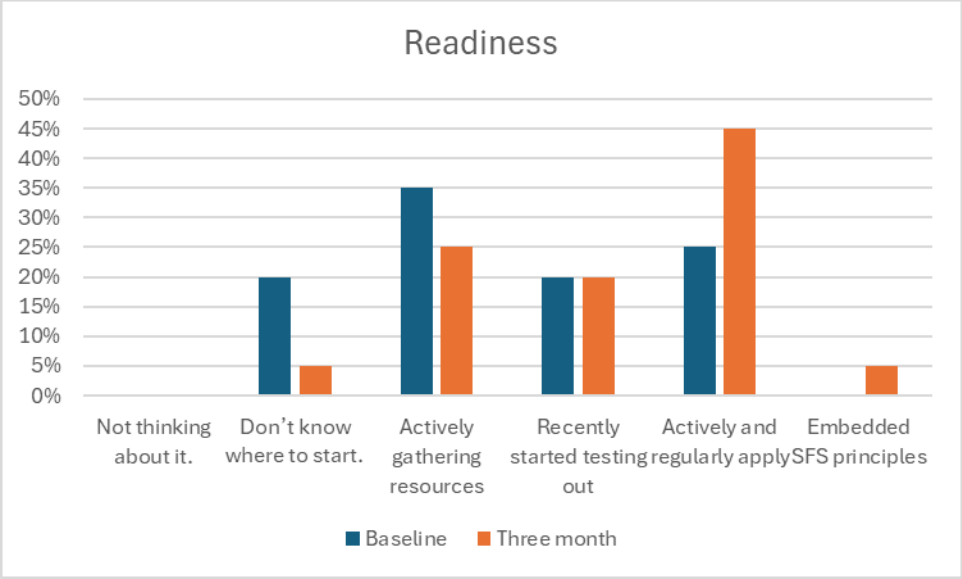


*Figure 5. Participants' baseline vs. three-month self-reported readiness to incorporate sustainable food system into practice.*

Overall, the three-month survey indicates a positive shift in participants' readiness to incorporate SFS into dietetic practice after completing the learning modules. The number of participants in the lower three levels of readiness decreased, while the number in the highest two levels increased, suggesting an increase in participant's readiness to apply SFS principles into their practice.

*Three-month open-ended survey results related to readiness (qualitative result)*

When asked about their readiness in the three-month survey after completing all three learning modules, participants provided various insights that emphasized that their readiness to incorporate SFS principles into practice has increased.

One participant mentioned: *"I like to individualize how I apply these principles based on the person I am dealing with. I think of implementing these principles in terms of a behaviour menu (e.g., eating less meat, eating locally, food safety with local food systems, waste reduction, and*

*diversion) that clients can choose from to increase the sustainability of their diets if that is their goal"* (P18). This participant demonstrates that they have a high level of readiness, as they not only implement SFS principles but tailor them to meet individual client needs.

Readiness was also demonstrated through specific projects and future planning initiatives. For example, one participant mentioned, *"I have identified one area and project where I can incorporate messaging and practical tips for applying sustainable food systems practices, specifically menu planning workshops for residential care facilities. To a limited extent, I have already started incorporating some messaging in a workshop I facilitated in the fall of 2023. I plan to incorporate more information and resources on sustainable food systems practices into workshops that will be implemented in 2024"* (P16). This participant readiness is evident in how they currently incorporate SFS into their current practice and how they are thinking ahead about how to further integrate SFS principles.

Another participant discussed planning new services with a sustainability lens: *"Currently, I am thinking about adding additional services for our patients. Something my coworkers and I have been discussing is adding cooking classes for caregivers to support our patients. I would like to use a sustainability lens when introducing and pitching this idea in terms of sourcing our food and deciding on recipes. I feel like using this toolkit, I am able to think more sustainably about the project"* (P17). This participant's readiness is high because they are ready to include SFS principles in their current project. This participant credited the toolkit from the learning modules as being useful in helping them.

Another participant indicated being ready and prepared to implement sustainable practices: "*In my current role, I feel ready and knowledgeable to implement more sustainable practices; however, time is the limiting factor. I am an administrative dietitian, and I place orders for the*

*hospital where I work. I always try to increase our local purchasing, but due to being in a supervisory role, the time I am able to spend researching new local products is limited*" (P19). This participant states that they feel ready and knowledgeable, a clear indication of increased readiness. Despite the challenges they face, their readiness is also evident in their desire to continue incorporating SFS into their practice.

Participants also highlighted ongoing efforts in incorporating sustainable diet choices*: "I started incorporating discussions around sustainable diet choices with some clients I see (client-centred), offering more of a discussion to choose which foods they include in their diets given consideration to sustainable choices as part of their decision process. I've included it as part of our food journal and record for clients to fill in pre-appointments as an area of interest to discuss with your RD. I have a lot to learn but have definitely incorporated my learning from the courses into practice already"* (P13). This participant's readiness is evident in their active inclusion in sustainability discussions with clients, demonstrating that they are applying the knowledge gained from the learning modules.

Some participants expressed a desire for further development and support in specific areas related to sustainability: *"I still want to learn more about region-specific so as to offer more detailed advice about sustainable companies and products"* (P13). This participant's desire for more knowledge still demonstrates readiness to act, as the participant is seeking ways to improve their capacity to incorporate SFS into their practice.

Collaborative efforts and initiatives aimed at promoting sustainability within work environments were also highlighted. One participant described, *"I have been developing public health projects with students to influence the health food system of my work institution through waste management, capacity building of clinical dietetics, and larger community development projects*

*in the region"* (P5). This participant is taking proactive steps to influence sustainability at an institutional level through public health projects. Their work indicates a high level of readiness to integrate SFS principles.

Another participant discussed collaborative efforts within their team: *"My work colleagues are generally open to taking some practical action, but other work priorities mean that there is little time for us to spend in this area"* (P9). This participant is ready to collaborate with colleagues on practical sustainability actions. Although there are challenges due to competing priorities, the openness to incorporate SFS principles indicates increased readiness.

In summary, participants' responses in the three-month qualitative result align with the survey results, which showed an overall increase in readiness to incorporate SFS into dietetic practice after completing the learning modules. Many participants demonstrated a proactive approach by tailoring SFS principles to individual client needs and integrating SFS principles into both current and future professional practices.

Several participants described ongoing projects or plans to implement sustainability, which reflected an increased level of readiness. Participant readiness was also reflected in their ability to maintain a commitment to sustainable practices while facing challenges, such as time constraints and limited resources. Collaborative efforts within work environments further increased participant readiness to incorporate SFS into their practice.

Overall, participants' insights revealed that they had moved up the readiness scale, translating their knowledge into practical, actionable steps in their dietetic roles. This shift reflects the positive impact of the learning modules on increasing dietetic professionals' readiness.

Confidence

In this first sub-outcome, we analyze whether participants' confidence in incorporating SFS principles into their dietetic practice increased after going through the learning modules.

*Quantitative result*

There are five ascending levels of confidence, with level 1 being the lowest: "Not confident at all" and level 5 being the highest: "Extremely confident." At baseline, 15% (3/20) of participants were at the lowest confidence level. 20% (4/20) were at the second level of confidence, 55% (11/20) were at the third level, 5% (1/20) were at the fourth level of confidence, and 5% (1/20) were at the highest confidence level.

Three months after completing the modules, the results in figure 6 showed an increase in participants' confidence levels. The percentage of participants at the lowest confidence level decreased to 0% (0/20). The percentage at the second level of confidence remained the same at 20% (4/20), and those at the third level decreased to 45% (9/20). The percentage of participants at the fourth level of confidence increased to 30% (6/20), while those at the highest level of confidence remained at increased to 5% (1/20).

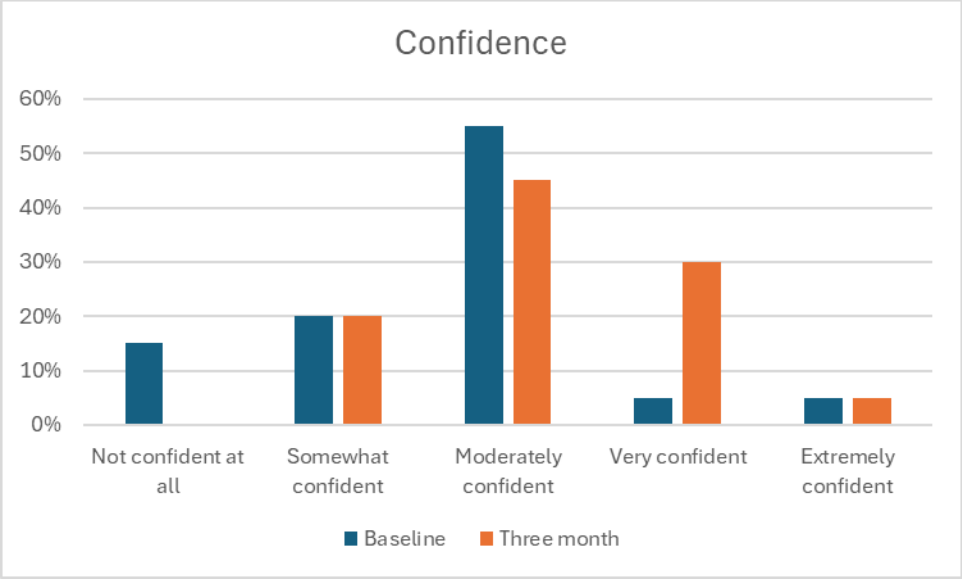


*Figure 6. Participants' baseline vs. three-month self-reported confidence to incorporate sustainable food system into practice.*

Overall, the three-month survey indicates a positive shift in participants confidence to incorporate SFS in dietetic practice after completing the learning modules. The number of participants in the second and third highest confidence levels increased. While those with the lowest confidence level decreased. This shift suggests a positive impact of the learning modules in enhancing the confidence of dietetic professionals.

*Focus group and open-ended survey (qualitative results) related to confidence*

The analysis of the baseline and three-month qualitative results indicates that participants' confidence increased after completing the ICDA learning modules. Participants discussed the various ways their confidence increased.

A common theme was that participants felt more confident because the learning modules provided an accessible and reliable resource. One participant expressed, *"I feel more confident in the sense that I know a place that I can go that is going to have reliable information and*

*resources that are actually relevant to me"* (P20). Another participant echoed this sentiment: *"Yeah. So, I also feel more confident in the sense that I know a place that I can go that is going to have reliable information and resources that are relevant to me instead of trying to do too much scavenging and other places and kind of digging through other things, trying to figure out what is specific to me, so I feel more confident in places that I can go to find a little bit more reliable and evidence-based information that's definitely more applicable to my practice."*(P17). These two quotes show that participant's confidence increased by having a reliable and relevant source of information to reference when needed. The modules provided participants with a clear, trustworthy resource they could reference, and that increased their confidence.

Participants also appreciated the comprehensive nature of the modules. One mentioned, *"What is great about this module is that it has pointed me to numerous sources of information and even inspiration about how I can incorporate sustainable food systems and diets into my work. So, I think confidence is about knowing where to find information and seeing colleagues trailblazing, so that's where the little kind of case studies come in that we discussed earlier."* (P6). Another participant noted, *"My confidence increased after learning these modules. There is a lot of up-to-date information. I trust this learning website to provide unbiased materials"* (P4). These two quotes highlight that the learning modules increased participant's confidence by offering them diverse sources of information.

Participant's confidence was further demonstrated in the focus groups, where participants discussed practical ways, they could incorporate SFS into their personal practices. For instance, one participant said, "*Yeah, I do think that I feel confident that I could apply a lot of this to my practice right now. I've just been keeping a list of things and different ideas to bring forward to management"* (P10). Another participant shared, *"I feel confident that I can use my nutrition*

*expertise to advocate for sustainable food practices within my university community"* (P1). These two participants expressed confidence by thinking of practical ways they can incorporate SFS into their practice. They felt empowered to bring ideas forward to management and advocate for SFS practices, showing they believed they could make tangible changes in their professional environments.

Participants also felt confident in their roles in policy advocacy and public health, as illustrated by the following quotes*: "I also feel confident that I can use my seat at the table in local, regional, and state/national policy advocacy to advocate for sustainable food policies (like reducing food waste and relocalizing food systems).”* (P1) and *"Yes, I feel more confident in how I can add value as an RD to sustainable efforts with my role in public health."* (P12). These quotes show increased confidence in participants' ability to advocate for SFS at various levels, from policymaking to public health initiatives.

However, confidence did not increase uniformly across all areas. One participant mentioned, *"I feel confident in advocating and working towards bringing more local producers. Another area where I feel less confident is in managing food waste."* (P19). Another stated, *"There are some areas where I see steps I could take and feel okay with those, but others where I am not sure what steps we could take"* (P7). These quotes highlight that while participants felt more confident in some areas, such as local sourcing, there were areas, like food waste management, where confidence was lower. This demonstrates that the learning modules boosted confidence overall, but there are still areas that need further development for participants to feel fully confident.

The analysis of the quantitative survey result showed that participant's confidence increased because they moved up the confidence level. The focus groups and open-ended qualitative responses reveal that participants' confidence in incorporating SFS into their practice increased

after completing the ICDA learning modules, in general, but that this was not uniformly true. A key factor in this increase was the accessibility and reliability of the modules, which provided participants with a trusted source of information. Many participants felt reassured knowing they had a dependable resource to consult. Additionally, the modules offered a wide range of information and inspiration, further increasing participants' confidence in their ability to implement SFS principles.

Participants expressed this confidence through their readiness to apply SFS concepts in practical ways, such as advocating for sustainability within their professional environments and bringing forward new ideas to management. Many also felt empowered to take on leadership roles in policy advocacy and public health, demonstrating their increased confidence in making a broader impact on sustainability efforts. However, the increase in confidence was not uniform across all areas, suggesting that additional support in these specific areas could be beneficial.

Overall, the learning modules were effective in boosting participants' confidence to incorporate SFS principles into practice; however, to better support participants the modules could be tailored to address areas where they lack confidence. This targeted approach could help participants feel more confident in all aspects of their practice.

*Barriers*

While participants' readiness and confidence to incorporate SFS into their practice have increased, they face several barriers to effectively implementing these principles. Common barriers include time constraints and a lack of organizational support.

One participant highlighted organizational constraints affecting their readiness: *"I am ready to incorporate SFS principles in my dietetic practice, but I am constrained by the organizational*

*structure I work in. Any changes need to be decided in collaboration with others, and we are not given time to develop new course content unless absolutely necessary. This has meant that I am not regularly able to apply it, though I am actively advocating and making changes where I can"* (P3).

Another participant echoed the sentiment of lacking time and support: *"I feel I have the knowledge to incorporate SFS principles into my dietetic practice; however, I often lack the time and support to do so"* (P19).

The challenge of balancing sustainability efforts with other work priorities was also mentioned: *"I have succeeded in raising the need to consider environmental sustainability, broadly speaking, in my work areas—the nutrition and dietetics department and clinical multidisciplinary team. We have just formed a small working group in nutrition and dietetics; the food services dietitian has done significant relevant work in the past, but sustainability is not prioritized in our health service. My work team has looked at waste separation and is considering energy use within our building. My work colleagues are generally open to taking some practical action, but other work priorities mean there is little time for us to spend in this area."* (P9).

Despite increased knowledge and confidence, participants face significant barriers that hinder the consistent application of SFS principles in their practice. Addressing these barriers through organizational support and prioritizing sustainability initiatives could better help dietitians.

### 3.5.3 Survey Anomaly

The survey and focus group data were primarily analyzed at the group level. However, two participants' responses were identified as unusual based on their significant deviation from the

group's average responses. These participants' data were also analyzed at an individual level to understand the differences and provide context for the overall results.

Participant #15 consistently remained at the lowest knowledge level across all four categories, maintaining the second lowest readiness level ("don't know where to start") and the second lowest confidence level ("somewhat confident") from baseline to the three-month survey. This participant's experience stands out, contrasting with others who showed varying levels of progression in knowledge, readiness, and confidence. This abnormal consistency necessitated re-examining the focus group data to assess this participant's engagement with the learning modules.

Insights from focus group discussions with this participant shed light on their experience, particularly regarding content related to weight bias, which they found off-putting.

In the first focus group, the participant had this to say about the first learning module: *"I think I want to just comment on the Danone video. It started strongly linking social justice and health equity, but halfway through, it lost that lens of power distributions or health equity. It wasn't as strong. I also noted that another video I was watching had unintended harm in that it was perpetuating weight stigma and weight bias."* The participant went on to say, *"I think some of the resources on the website are good. However, we need to reflect upon some unintentional harms that could be perpetuated, especially in the field of dietetics."*

In the second focus group, the participant also mentioned reading a document about weight stigma in the second learning module. *"I read the entire paper, which made me more disengaged and angrier. Uh, it was very weight biased. And so, it really turned me off to want to continue.*

*So, I had to take time away and then return to do the module.* When asked to clarify, the participant continues, "*It was the first paper that made these heavy statements around health and nutrition, and they talk about how overconsumption leads to obesity. And while it talks about the social determinants of health, it really just made a whole leap and ignored the social determinants piece, so it just gave me a really heavy gut reaction to the paper."*

The module's weight-biased content likely contributed to this participant's limited benefit from the learning module. Also worthy to note is that this participant attended the third focus group, but did not participate in the discussions. This anomaly is important because it highlights the potential impact of module content on participant engagement and benefits. This observation is crucial for the ICDA and other learning tools to consider, ensuring that their content is mindful of potential impacts that may affect participants' engagement and limit their benefit from the learning program.

Participant #5 also remained at the lowest knowledge level across three sections—food systems, environmental sustainability, and social sustainability—from the baseline to the three-month survey. In the three-month survey, this participant self-reported decreased knowledge of sustainable diets. Despite this, their readiness and confidence levels increased. This result was an anomaly because, unlike other participants, who generally showed consistent patterns between knowledge, readiness, and confidence, this participant exhibited low and decreasing knowledge while simultaneously showing increased readiness and confidence. Insights from the focus group revealed that the participant struggled with conflicting evidence within the modules regarding health perspectives, which may have resulted in their consistent low knowledge level. *"The links in the modules make me feel less confident because I feel like there is a lot of knowledge I*

*haven't read, and I have limited time to go through them*" (P5). The participant goes on to say, "*I'm unsure if it's a paradox. I feel that the links and all the information on the modules are good to be there. So, when we have time, we can go back. But also, I feel less confident after reading all the essential knowledge without having time to go through all the links."*

The participant also noted that the complexities of SFS impacted their confidence: "*There are so many conflicts, e.g., healthy but higher impact or unhealthy but lower impact food exist. My confidence about sustainable diet is lower, as I do not know what the diet looks like now."*

These anomalies highlight dietetic professionals' difficulty in fully understanding SFS and areas where training programs can improve their understanding. This insight emphasizes the importance of knowledge presentation and the importance of guiding dietetic professionals effectively through the complexities of SFS.

### 3.6 Discussion

By evaluating the impact of the ICDA online learning modules on dietetic professionals' competence and confidence, this chapter provides valuable insights into the professional development of dietetic practitioners. The results from the baseline and three-month surveys show that participants' self-reported knowledge of food systems, sustainable diets, and social and environmental sustainability increased after engaging with the learning modules. Additionally, participants reported an improvement in their readiness and confidence to incorporate SFS into their practice.

Key Findings and Comparisons to Previous Research

Previous studies, such as those by Wegener (2018), identified the need for training methods to prepare registered dietitian nutritionists (RDNs) to incorporate SFS into their practice. Wegener's research highlighted a gap in RDNs' knowledge, which limited their ability to implement SFS principles effectively. The ICDA learning modules were created in response to this gap, aiming to equip dietitians with the skills and knowledge needed to integrate sustainability into their practice. The findings from this thesis demonstrate that the modules succeeded in enhancing participants' knowledge and understanding of SFS, confirming their value as a training tool for dietetic professionals. Hawkins et al (2015) is a study that emphasized the importance of equipping dietitians with the knowledge to apply SFS to their practice. By improving participants' knowledge of SFS, the modules helped bridge the knowledge gap previously identified in the literature.

When assessing competence, this thesis used the Dreyfus model of skill acquisition (Peña, 2010), which outlines five stages of expertise development. Competence develops through the accumulation of knowledge and experience, and this research study suggests that participants are progressing along this stage. While the short study duration limits the direct measurement of experience, participants' self-reported knowledge increase can be used based on the Dreyfus model to infer that their competence is increasing as well (Peña, 2010). Woolfolk (2013) noted that acquiring knowledge is fundamental to developing competencies, and the findings of this thesis suggest that participants are building both their knowledge and their competence in SFS.

Interpretation of Findings

While this thesis result chapter indicates an overall improvement in knowledge, competence, readiness, and confidence, there are areas where additional focus is needed. Notably, social sustainability emerged as a weaker area, with only 55% of participants reaching the highest knowledge level in this aspect. This contrasts with at least 80% of participants achieving high knowledge levels in food systems, sustainable diets, and environmental sustainability. These findings suggest that the learning modules may require further improvements to teach dietetic professionals about social sustainability. Seeing as social sustainability is an essential component of SFS improving training in this area could improve participants' understanding and application of SFS principles in practice.

Increased readiness and confidence to incorporate SFS into dietetic practice were also key results of this research study. Chorrojprasert's (2020) findings indicated that higher levels of readiness and confidence make professionals more likely to take actionable steps. Participants' increased readiness was evident in their desire to apply SFS principles to their practice. The accessibility and reliability of the modules increased participants' confidence, a critical aspect in decision-making, and empowered them to take practical steps in applying SFS principles to their various work projects.

However, the increase in confidence was not uniform across all areas. For example, participants expressed lower confidence in other tasks like food waste management. This suggests that while the modules are effective, additional support and resources may be necessary to address other areas of SFS. Tailored content that specifically addresses various areas of SFS could further increase participants' confidence across all areas of practice.

Addressing Barriers and Recommendations

Despite the increase in competence, readiness, and confidence, participants continue to face barriers, including time constraints, organizational limitations, and a lack of managerial support. These barriers, echoed by Heidelberger et al. (2017), Guillaumie et al. (2020), and Carlsson & Callaghan (2022), are significant and beyond the scope of the learning modules. While the modules can bridge knowledge gaps, they cannot directly resolve structural and institutional challenges. Therefore, addressing these barriers will require systemic changes within various organizations.

Based on the findings of this study, several recommendations are listed below to improve the ICDA learning modules and support dietitians in integrating SFS principles into practice:

1. Tailoring content to address social sustainability: Since knowledge increase in social sustainability was more limited, enhancing this content could help participants develop a more comprehensive understanding of SFS. Tailoring the learning module to delve deeper into social sustainability can better equip dietitians to address these areas in their practice.

2. Developing resources for time management: The ICDA should develop content or practical resources that provide time management strategies tailored to dietetic professionals. These tools could help dietitians maintain their commitment to sustainable practices while managing their busy schedules.

3. Supporting balance of work priorities: Offering tools that can help dietetic professionals balance competing priorities could empower them to set realistic sustainability objectives and integrate these into their existing professional capacity.

4. Offering personalized learning pathways: Given that participants expressed varying levels of confidence in different areas, the ICDA should introduce more personalized learning pathways within the modules. This would allow participants to focus more intensively on areas where they feel less confident, such as food waste management or policy advocacy.

5. Ensuring content is free of weight bias and stigma: All module content, particularly related to health and nutrition, should be carefully reviewed to avoid weight bias and stigma. Ensuring that the content aligns with dietetics and public health best practices creates a more supportive learning environment.

6. Simplifying complex information: In order to avoid overwhelming participants, the presentation of complex or potentially conflicting information should be simplified. Clarifying contradictions and offering clear, actionable steps can help participants better understand and engage with the material.

### 3.7 Limitations

This pilot study provides valuable insights into the effectiveness of the three ICDA's online learning modules in increasing dietetic professionals' confidence and competence in SFS. Despite the care and effort put into this research study, it has some limitations. One notable limitation is the small sample size, while the sample size is consistent with the study's qualitative design and purposive sampling strategy. There are several limitations that come with having a small sample size. For one, smaller sample sizes limit the generalizability of the quantitative results (Yang & Berdine, 2023). It can also have limited transferability, meaning this research's findings might be difficult to apply in other contexts (Vasileiou et al., 2018). However, since the

aim of this thesis study was to examine dietetic professionals who engaged with the learning modules and conduct an in-depth exploration on the usefulness of the modules there was no need to focus on a sample that is representative of the broader population of dietitians; a small sample size would still allow us to answer our research question. Therefore, while a larger sample might have provided more varied perspectives, this study was able to answer the research question.

Another limitation is the lack of geographic diversity, with participants drawn primarily from Canada and Australia. These two countries share similarities in terms of culture, history, and economic context, which may have influenced participants' experiences and feedback on the learning modules. Future studies would benefit from including participants from a wider range of countries and cultural contexts; to determine how applicable and effective the modules are across diverse settings.

No advanced statistical tests were conducted in this study. This was not due to sample size limitations but rather because the research was primarily qualitative in nature, aiming to explore trends and insights rather than draw statistically significant conclusions. Descriptive statistics were used to observe patterns in participants' knowledge, readiness, and confidence levels, aligning with the study's exploratory goals. However, future research with a larger sample size could benefit from inferential statistical analysis to deepen the quantitative insights.

Lastly, the time interval between the baseline and the three-month follow-up surveys may have introduced recall bias. The follow-up survey was conducted six months after the baseline survey, with participants completing the learning modules three months before the follow-up. This extended time frame might have affected participants' ability to accurately remember their initial knowledge and confidence levels, potentially influencing the self-reported changes (Kraemer et

al., 2022). Shorter intervals between data collection points could help reduce this risk in future studies.

### 3.8 Conclusion

In conclusion, this study demonstrates that the ICDA learning modules effectively increase dietetic professionals' knowledge, competence, readiness, and confidence in incorporating SFS into their practice. While the modules address some of the knowledge-based barriers, there are still challenges at the organizational level that need to be addressed for dietitians to fully implement SFS principles. Providing additional support within organizations is critical to empowering dietitians to overcome these barriers.

The findings of this research study highlight the value of the ICDA modules in enhancing dietetic professionals' self-reported confidence and competence in applying SFS principles. However, the modules are not without limitations. Continuous improvement, particularly in social sustainability, is necessary to improve their effectiveness. Regular updates informed by the latest research will also ensure that the modules remain relevant and impactful.

The recommendations provided in the discussion section aim to further strengthen the integration of sustainability into dietetic practice. Dietitians will be better equipped to lead the shift toward more SFS by improving educational resources and fostering a supportive professional environment.

Ultimately, this study highlights the critical role the ICDA learning modules can play in enhancing the competence and confidence of dietitians in SFS. It supports the broader objective of promoting a more SFS, ensuring that dietetic professionals are well-prepared to advocate for both health and sustainability in their practice.

# Chapter 4: Evaluating the Role of Content and Design Features of the ICDA modules in Enhancing Dietetic Professionals' Competence and Confidence in Sustainable Food Systems

**Co-Authorship Statement**

This chapter was written by Phebe Oluwafemi with edits provided by Dr. Rachel Prowse, Dr. Liesel Carlsson, Dr. Olga Heath, and Dr. Atanu Sarkar. Funding for this study was secured by Dr. Liesel Carlsson and Dr. Rachel Prowse. Ethical approval was obtained from Memorial University and Acadia University by Phebe Oluwafemi, Dr. Liesel Carlsson, and Dr. Rachel Prowse. Data collection was carried out by Phebe Oluwafemi, Dr. Liesel Carlsson, and Dr. Rachel Prowse. The focus group questions were designed by Phebe Oluwafemi, Dr. Rachel Prowse, and Dr. Liesel Carlsson, with input from Dr. Olga Heath and Dr. Atanu Sarkar. Data analysis was conducted by Phebe Oluwafemi, with input from Dr. Rachel Prowse and Dr. Liesel Carlsson. This chapter has not been submitted for publication, but submission will be undertaken by Phebe Oluwafemi.

### 4.1.1 Introduction

Our global food system is a complex web of interconnected activities, actors, and processes involved in the production, distribution, consumption, and disposal of food (Food and Agriculture Organization (FAO), 2018). From agricultural production to food processing, transportation, retail, and consumption, these activities all influence and shape the availability, accessibility, and quality of food (FAO, 2018). However, the sustainability and long-term viability of this complex system are being called into question due to challenges of population growth, resource depletion, environmental degradation, and food insecurity (Holden et al., 2018; Zinsius, 2013).

The FAO defines a sustainable food system (SFS) as a food system that ensures access to safe, nutritious food for all while minimizing environmental impact, conserving resources, and promoting social equity (FAO, 2018). A SFS seeks to strike a balance between meeting the needs of the present without compromising the ability of future generations to meet their own. This approach recognizes the interconnectedness of our economic, social, and environmental dimensions and emphasizes the need to address these challenges through sustainable solutions (Lee-Gamage, 2017).

With a growing global population and depleting natural resources, the need to transition towards a SFS has never been more critical. According to Hewitt (2024), as the population continues to increase, the demand for food will also increase, placing an enormous strain on already limited resources. Without sustainable practices in place, the risk of food insecurity, malnutrition, and environmental degradation will only increase, exacerbating existing inequalities and threatening the well-being of current and future generations (Hewitt, 2024).

Amidst these challenges, dietetic professionals emerge as key stakeholders in the journey towards SFS. Trained in nutrition and health, dietitians possess the expertise and knowledge necessary to promote healthy eating habits, address dietary-related diseases, and advocate for a SFS (Dietitians Australia, 2020). As trusted advisors and advocates, dietitians wield considerable influence in shaping food policies, educating the public, and supporting sustainable food practices at the individual, community, and institutional levels (Spiker, Reinhardt, et al., 2020).

However, despite their pivotal role, dietetic professionals face numerous challenges in integrating SFS principles into their practice. Guillaumie and colleagues conducted a 2020 research study that highlights barriers such as limited resources, inadequate training, and knowledge gaps regarding sustainable food practices. Additionally, time constraints and competing priorities often hinder dietitians' ability to prioritize sustainability initiatives within their practice (Heidelberger et al., 2017). Recognizing these challenges, there is a need to equip dietetic professionals with the knowledge, skills, and confidence needed to effectively promote and integrate SFS principles into their practice.

The International Confederation of Dietetic Associations (ICDA) has taken steps to address these challenges by developing three learning modules aimed at enhancing dietetic professionals' competence and confidence in SFS. These modules, accessible online, offer a comprehensive list of resources, including videos, readings, reflective exercises, and case studies, designed to provide dietetic professionals with the tools needed to integrate SFS principles into practice.

Chapter three results section provided strong evidence that, overall, the modules are effective in increasing confidence and competence for most users. In this study, we examined the ICDA module content and design to better understand which features were effective in increasing confidence and competence and which features need improvement.

Research Objective

This study seeks to evaluate the content and design features of the ICDA modules that can enhance dietetic professionals' competence and confidence in sustainable food systems. The results of this study can inform the ICDA of potential improvements to their learning modules and guide the development of future training applications.

Research Question

What content or design features are most effective in increasing dietetic professionals' competence and confidence?

### 4.1.2 Definitions

The following key terms for this study are defined below:

- Competence: Having a thorough understanding of the ideas, theories, and best practices that are associated with sustainable food systems and the ability to apply them effectively in practical situations (Hooper et al., 2014).
- Confidence: Dietetic professionals' self-assurance and trust in their ability to successfully integrate sustainable food systems into their practice (Budin, 2017).

## 4.2 Philosophical Paradigm and Methodological Approach

This study was approached using a constructivist research paradigm. This paradigm aligns with the belief that reality is subjective and constructed through individual perceptions and interpretations (Teherani et al., 2015). The researcher acknowledges an active role in the research process, understanding that knowledge is co-constructed through interactions with participants (Tashakkori et al., 2020). Rather than aiming for objectivity, this paradigm emphasizes

understanding participants' experiences and perspectives within their sociocultural contexts (Tashakkori et al., 2020).

Within the constructivist paradigm, a descriptive qualitative research approach was used to explore the content and design features most effective in increasing competence and confidence among dietetic professionals. Qualitative descriptive research seeks to provide a detailed account of the topic of interest by focusing on describing its characteristics and nuances (Doyle et al., 2020). This approach allows for flexibility in data collection and analysis, enabling researchers to adapt methods to capture the complexity of participants' experiences (Doyle et al., 2020).

The qualitative descriptive approach is particularly suitable for exploring the content and features of the ICDA learning modules that increased dietetic professionals' confidence and competence. This method allowed for a rich exploration of participants' perspectives and preferences (Doyle et al., 2020). By delving into the intricacies of participants' experiences, this approach uncovered valuable insights into the strengths and weaknesses of the training modules, as well as areas for improvement (Doyle et al., 2020). Additionally, the qualitative descriptive approach enabled the researchers to generate findings that could inform the development of future training programs and interventions (Doyle et al., 2020).

### 4.3 Methods

Ethics approval was obtained from the Health Research Ethics Board (HREB) and the University of Acadia, ensuring that the study adhered to ethical guidelines for research involving human participants. The research was conducted under the project title "Exploring Models and Approaches for Training Sustainable Food Systems in Dietetic Practice: A Pilot Study," with HREB file number 20240045 and Acadia file number REB 23-24.

### 4.3.1 Participants and Sampling

Participants were recruited based on specific inclusion criteria. The inclusion criteria was that participants were registered dietetic professionals over the age of 18 with at least one year of professional experience. Participants were registered dietitians or dietetic professionals registered with their respective regulatory bodies.

Canada and Australia were chosen for this study as they have similar dietetic education frameworks, making them ideal contexts for evaluating the effectiveness of the learning modules. Dietitians who were trained in Ontario, Canada, can transition to practice in Australia through a credential recognition process and vice versa. The comparability of their educational backgrounds and professional competencies is similar, making them ideal for testing the learning modules (Dietitians Australia, 2023).

Recruitment efforts targeted dietetic organizations, newsletters, SFS conferences, and professional networks. Recruitment infographics and advertisements are included in Appendices II and III.

In Canada, In Canada, participants were recruited through the Dietitians of Canada (DC) website and sustainability distribution lists. Additional recruitment efforts targeted dietitians across various provinces through email contacts and professional networks. 15 Canadian participants were recruited, with 11 completing all three focus groups.

Australian participants were recruited through advertisements at a SFS conference. Ten Australian participants were recruited, with nine completing all three focus group discussions.

All participants received a $30 CAD honorarium for participation and an additional $70 CAD for completing the three-month follow-up survey.

## 4.4 Data Collection and Analysis

### 4.4.1 Data Collection

Data for this research study was collected through focus group discussions facilitated by the researchers using Cisco Webex. Each session was recorded for transcription and analysis. Participants were divided into two groups: Australian and Canadian. A total of six focus groups were conducted—three with Australian participants and three with Canadian participants. Each focus group concentrated on one of the three ICDA learning modules. The focus group meeting was conducted after participants reviewed the learning modules. The focus group questions are listed in Appendices IV-VI.

During the focus group meetings, participants were asked to keep the content of the focus group private and not divulge what was said in the focus group or who participated. Participants utilized the hand raise function on Webex, and when called upon by the facilitator, they shared their thoughts. The discussions were marked by participants' openness in sharing their perspectives while ensuring that everyone had the opportunity to speak without talking over one another. Each focus group was scheduled for 90 minutes, with actual meeting durations averaging 65 minutes. The sessions were recorded, and the Cisco Webex transcription feature initially generated non-verbatim transcriptions, which the researcher edited for accuracy. Additionally, written notes were accepted and considered alongside the recordings and transcriptions.

### 4.4.2 Data Analysis

Thematic analysis, as outlined by Braun and Clarke (2006), served as the framework for coding the focus group data. This method enabled the identification of patterns and themes and the

organization and interpretation of the dataset. Transcribed discussions were carefully reviewed, and codes were assigned to segments representing key ideas and concepts (Braun & Clarke, 2006). These codes were then grouped into categories relevant to participants' experiences with the online learning modules (Braun & Clarke, 2006).

The researcher analyzed the coded data to identify patterns and connections and subsequently defined and named themes (Braun & Clarke, 2006). The themes identified from both focus group sessions were compared to identify similarities, differences, and potential contradictions in participants' responses (Braun & Clarke, 2006). Direct quotes from the transcriptions were utilized to support the findings and provide context. NVivo version 14 was used for coding, with codes cleaned and combined and a codebook created to ensure consistency in the analysis of Australian and Canadian data.

### 4.5 Rigor and Validity

In this study, several strategies have been employed to enhance rigour, thereby strengthening the overall quality and trustworthiness of the research (Leung, 2015).

Methodological Coherence: Methodological coherence enhances the rigour of a qualitative study by ensuring that all aspects of the study are aligned and appropriate for its objectives (Poucher et al., 2019). A key strategy for achieving this is the careful selection of an appropriate study design (Johnson et al., 2020). This research utilized a descriptive-qualitative approach, which allowed for an in-depth exploration of participants' perspectives and experiences with the online learning modules (Doyle et al., 2020). This approach was selected for its ability to capture rich, detailed data and provide valuable insights into the content and design features of the modules (Johnson

et al., 2020). It is well-suited for qualitative research and effectively addresses the research question.

Focus group Questions: To enhance the rigour and validity of the study, the focus group questions were carefully designed to align with both the research objectives and the learning module goals. Each question, along with its prompts, was selected to directly address the research question. Additionally, after each focus group session, the questions for the subsequent sessions were revised to gather more comprehensive data.

The focus group questions were developed in advance, drawing from the learning modules themselves as well as broader questions related to confidence and competence. After each session, the research team reviewed participant responses and made necessary adjustments, ensuring the questions remained relevant and provided the most valuable insights. If participants had already addressed a particular topic, some questions were removed, while new ones were introduced to further explore areas requiring more depth. This approach strengthened the quality of the data collected, ensuring that the study effectively captured participants' perceived competence and confidence.

Thematic Analysis Methodology: The rigour and validity of this research are enhanced by the effectiveness of the analysis tools employed (Leung, 2015). Thematic analysis was used as the primary method for analyzing focus group data. This method is well-suited for qualitative research as it identifies patterns, themes, and connections within the data (Braun & Clarke, 2006). By systematically coding and analyzing the transcripts, the study aimed to uncover the underlying meanings and interpretations of participants' experiences with the online learning modules, thus contributing to the study's overall rigour and validity (Braun & Clarke, 2006).

Immersion in the Data: Immersion in the data is another crucial aspect of ensuring rigour and validity. In this research study, the researcher immersed herself in the data by repeatedly reading and familiarizing themselves with it (Braun & Clarke, 2006). A key component of the thematic analysis is immersion. This process helps researchers gain a deep understanding of the participants' perspectives and responses, thereby facilitating more accurate analysis and interpretation of the data (Braun & Clarke, 2006).

Transparency and Documentation: Transparency and documentation of the research process are essential for ensuring rigour and validity (Johnson et al., 2020). Throughout the study, researchers meticulously document all aspects of the research process, including data collection, analysis, and interpretation. This documentation allows for the replication of the study by other researchers and enhances the credibility of the findings (Braun & Clarke, 2006).

Member Checking: Member checking is a technique used to validate research findings by seeking feedback from participants on preliminary results (Birt et al., 2016). Before each new focus group session, researchers relay the main findings from previous sessions to participants to ensure accuracy and completeness. This process helps to confirm the validity of the findings and identify any areas for further exploration or clarification.

By employing these methods and techniques, this research study hopes to ensure that the findings are robust, credible, and trustworthy. Through transparency, documentation, and member checking, the study upholds the standard and contributes valuable insights to the field of SFS training in dietetic practice.

## 4.6 Results

Three main themes were identified that addressed the research question. These themes include learning environment and approach, engagement and interaction, application and practicality. Each theme will be discussed in detail, with direct quotes from participants used to support the findings. A summary of the findings is included in a Table in Appendix II.

### 4.6.1 Learning Environment and Approach

The first theme, learning environment and approach looks at how the structure and delivery of the learning modules influence dietetic professionals' competence and confidence in SFS. This theme focuses on learning styles, and mode of learning. Within this theme, three sub-themes emerged: flexibility and self-directed learning, diverse learning styles, and structured page layout.

Flexibility and self-directed learning

When asked about the learning module's online format, many participants appreciated the online, self-directed format, highlighting the flexibility it offered in terms of pacing and content selection. One participant noted, *"I think the self-directed format and the online are fine. I think people probably like to be able to work at their own pace." (P2).* Another participant expressed that they liked that the module was online as it allowed them *to "stop the video at any time to think and generate ideas and responses"* (P6).

The module's online and self-directed nature provided participants with significant advantages, primarily the flexibility to work at their own pace and delve deeper into the readings. This flexibility allowed participants to spend varying amounts of time understanding the content, with some dedicating three, four, and even six hours to the first module. This flexibility allowed for

the thorough absorption of knowledge and contributed to enhancing participants' competence in SFS.

The flexibility of the online learning modules allowed participants to focus on areas where they felt their knowledge was weaker or where they had the most interest. This self-directed approach gave them the ability to spend more time on specific topics, which contributed to a deeper understanding of SFS and how to apply that knowledge to their practice. Allowing participants to have flexibility and self-direct their study could increase their competence in SFS as it allowed them to gain a deeper understanding of SFS and learn how to apply that knowledge to their practice.

Participant feedback highlights that flexibility and self-directed learning play a role in enhancing the competence of dietetic professionals. The ability to self-direct their learning allows participants to thoroughly engage with the material, which supports a deeper understanding of SFS. Given the demands of dietetic professional schedules, incorporating flexible, online, and self-paced learning methods can help enhance their knowledge of SFS.

Diverse learning styles and content

Within the focus groups, diverse learning styles emerged as a significant subtheme during the data analysis process. The data analysis revealed that having a variety of learning options, such as visual, auditory, and reading, can enhance learning, thereby increasing the competence of dietetic professionals. Participants in the study also highlighted the importance of having varied learning options. One participant expressed, *"Part of my learning is best visual, so the videos were great."* (P17) The first learning module on the ICDA website included four videos introducing SFS, which participants found beneficial as it reduced their reading times and

facilitated better knowledge absorption. However, the next two learning modules had fewer videos and prompted complaints from many participants, who emphasized the value of visual aids in aiding knowledge retention and comprehension.

Participants also emphasized the need to mix learning styles. One participant noted that lengthy readings could be dry and less engaging and advocated for the inclusion of graphics, audio, and videos to complement the reading, as they aid in breaking up the reading and enhancing understanding. Participants' reading length preferences varied, with many preferring shorter readings for easier comprehension, while some appreciated longer texts for deeper learning. Recognizing these diverse learning styles is crucial for fostering competence among dietetic professionals and ensuring that individuals with different preferences have equal opportunities to learn.

This research supports the notion that having diverse learning styles can increase the knowledge, skills, and competence of dietetic professionals.

In addition to diverse learning styles, diverse content also plays a significant role in enhancing knowledge and competence among dietetic professionals. Many participants appreciated the inclusion of various resources and perspectives within the ICDA modules, noting the value of having diverse content on SFS in one accessible space. One participant said, *"If I encounter questions about sustainable diets, I know where I can look for information."* (P4). This diverse content on the ICDA modules, sourced from different organizations, viewpoints, and countries, provided participants with a comprehensive understanding of the topic.

Some participants cited specific content, such as the Sustainable Development Goals (SDG) briefs and sustainability illustrated materials, as being beneficial in enhancing their knowledge.

Participants also praised supplementary resources, including those from the Food Climate Research Network, for their value in deepening their understanding. By incorporating diverse content, dietetic professionals can expand their knowledge and gain a better understanding of the topic, which enhances their competence. Access to various information sources also allows participants to select materials that resonate with their learning preferences and facilitate effective learning.

Structured layout

The third component of learning style and approach is the structure of the layout. The results showed that the layout of a page impacts dietetic professionals' competence. Page layout includes the page's structure, ease of navigation, and presentation of information.

Breaking pages into smaller sections can help facilitate the thorough absorption of knowledge. One participant noted, *"I did like the way the page was broken into defined headings because it made them sort of defined chunks. So, you felt there was sort of a natural pause point."* (P21) Many participants found that breaking the page into sections aided their comprehension by allowing them to focus on one section at a time.

However, the same participants suggested that they would prefer each section to be on its own page rather than having the entire module on one page. *"I wonder if maybe each heading could almost be its own page just so that, even more visually, there's a breakpoint to give time to really focus on those reflective questions" (P21*).

For some participants, having the module on one page felt overwhelming and distracting. They found it difficult to know where to focus their attention when faced with the entire page at once. **"***I find I'd like to jump to the next thing if I can see it. So, I probably didn't spend as long on*

*those reflective questions as I might have" (P15),* one participant admitted. Additionally, participants struggled to maintain their place on the page when returning to it later, often forgetting where they left off. They noted that because each module was on one page, they often couldn't finish it all in one sitting and often forgot their spot on the page when they went back.

Participants appreciated the ease of navigation within the modules, particularly when locating additional resources, glossaries, and readings. One participant noted that the website layout was "very intuitive" (P22), praising how easily they could find specific resources such as papers, courses, and videos. The learning modules followed a consistent structure with clear headings addressing core objectives. Each section ended with a "Reflect" segment, which encouraged participants to apply the material to their practice, and a "Keep Learning" section offering more resources for deeper exploration.

Another aspect participants valued was the logical flow of information. Objectives were clearly listed at the beginning of each module, giving a concise overview of the content to be covered. This allowed participants to orient themselves and prepare for each section. The organized presentation of topics, subheadings, reflections, and supplementary resources facilitated a step-by-step learning process, making absorbing and applying the material easier.

While content is crucial for facilitating knowledge and increasing competence, our study highlights the importance of page layout for increasing competence. Factors such as structure, ease of navigation, and information presentation have an impact on dietetic professional's self-reported competence. Participants struggling to focus on the single-page format highlight the importance of optimizing page layout to enhance the understanding and competence of dietetic professionals.

The first theme of this research study examined how the learning environment and learning approach contribute to the competence of dietetic professionals. Providing flexibility and self-directed learning enables dietetic professionals to grasp and retain more information, thereby enhancing their competence. Additionally, a diverse range of content and learning styles can increase dietetic professional's competence by catering to individual preferences and facilitating effective learning. Furthermore, the layout of a page contributes to participants competence. Improving page structure, navigation ease, and information presentation can increase the competence of dietetic professionals.

Overall, a conducive learning environment and approach, including flexible learning options, diverse content, and structured layout, are essential for enhancing professional knowledge absorption and understanding of SFS.

### 4.6.2 Engagement and Interaction

The second theme that emerged from the focus group is engagement and interaction. This theme examined how interactive learning, peer discussion, and reflective learning can increase the competence and confidence of dietetic professionals. In this theme, we examined the importance of engaging participants through interactive sessions, the need to facilitate peer-to-peer interaction, and the need to promote reflective exercises, all of which contribute to building confidence and competence. There are two subthemes under this theme: reflective learning, where we examined the effect of reflective learning on participants' competence, and interactive learning and peer discussion, where we evaluate the effect interactive learning has on participants' confidence and competence.

Reflective learning

At the end of each section in the ICDA learning module, there are several reflective questions. The reflective section included questions or activities for participants to complete.

In the first module on the ICDA website, a sample reflective question was posed: *"What role do you play in the food system as an individual and as a nutrition and dietetics professional?"* (ICDA, 2022a). The first, second and third learning module on the ICDA website features a variety of reflective questions aimed at promoting self-awareness and different perspectives while encouraging the practical application of the readings.

One of the reflective questions in the third module asked participants to do an activity. *"Did any of the tools for practice spark new ideas for you about how you can creatively approach sustainability in your practice? If yes, what ideas were sparked? Create a brainstorm list or idea map and keep it in your files or on your office wall to remind you. Write down any tools that might be helpful."* (ICDA, 2022c).

Reflective questions like those in the three ICDA learning modules are effective in facilitating knowledge acquisition, skill development, and competence. The usefulness of the reflective questions was also noted by participants. One participant noted, *"I especially like the reflective questions; they helped me solidify my learning"* (P18). This demonstrates that reflective questions help deepen participants understanding and knowledge of SFS.

The participant also mentioned *"For the reflective question, it's nice to have something that forces me to think about and explain it to someone; you know, it helps reinforce my learning a lot"* (P18). Participating in the reflective question allowed this participant to internalize their knowledge and understanding of SFS. Helping them explain SFS principles in their practice.

Similarly, one participant also noted that "*self-directed reflection questions were helpful to consolidate my learning"* (P5). For this participant, the modules helped them gain a deeper understanding of SFS. Most of the participants appreciated the reflective questions as they reinforced and consolidated their learning, which is a crucial aspect of building knowledge and, thereby, competence in dietetic professionals.

Overall, incorporating reflective questions is essential for enhancing dietetic professional's competence. Reflective questions help bridge the gap between abstract knowledge and practical application by fostering deeper understanding and empowering professionals to apply their learning in real-world contexts.

Interactive learning and peer discussion

The second subtheme, interactive learning and peer discussion highlights the importance of fostering engagement and interaction among participants to enhance their confidence and competence. The data analysis revealed that incorporating a discussion forum or platform for participants to communicate with each other can improve their confidence and competence.

During the focus group discussions, the absence of a discussion forum in the ICDA learning modules was a frequent concern brought up. Participants expressed the desire for an online forum to exchange insights and ideas. As one participant remarked, *"I think having an online forum or online post would be nice for this purpose; I like hearing what other RDs think"* (P18). Another participant mentioned that *"hearing the reflections of others would help me confirm my knowledge and expand my understanding"* (P3). For many, having a platform to discuss with other dietetic professionals offers a valuable opportunity not only to connect but to learn from their peers. Another participant mentioned that having a discussion forum would make it easier to share experiences and ideas, which could enhance mutual learning.

Engaging in peer discussions not only fosters learning but also boosts the confidence and competence of dietetic professionals. One participant expressed that witnessing their peers' contributions might increase confidence in their ability. As one participant articulated, *"I think my confidence would be further increased by group discussions with other participants via online groups or forums"* (P8).

Additionally, observing how other dietetic professionals contribute to SFS can inspire participants and increase their confidence in SFS. Many participants find inspiration in their peers' actions, which motivates them to integrate SFS into their practice. Furthermore, the interactions reassure them that they are not alone and foster a sense of belonging to a larger community, which increases their confidence.

While the reflective questions in each module served as valuable prompts, many participants voiced their desire to have a platform where they could respond to the reflective questions and gain insights from others' dietetic professionals' responses. Even in the focus group meeting, as a researcher, I observed that participants active contribution of their insights and experiences enriched the learning environment. This collaborative exchange can nurture learning and bolster participants' confidence to apply SFS in their practices.

Overall, allowing interactive learning and peer discussion, primarily through the use of a discussion forum, could increase competence among participants as it will enable them to absorb and gain knowledge from hearing other professionals' perspectives. Confidence can also be built as it will enable participants to be challenged by and challenge their peers and learn practical ways to incorporate SFS into their practice. Dietetic professionals' confidence can also be built by the knowledge that they are not alone and that they are a part of a broader movement.

The second theme for this research study is engagement and interaction. In this theme, we examined how reflective questions can increase competence, as well as how interactive learning and peer discussion increase confidence and competence among dietetic professionals. Building competence and confidence in dietetic professionals is facilitated through active engagement and interaction. By prompting participants with reflective questions, we can enrich their understanding, thereby enhancing their competence. Additionally, fostering interactions among participants contributes to bolstering their confidence in applying SFS in practice. In summary, engagement and interaction were perceived as important in increasing dietetic professionals' competence and confidence levels.

### 4.6.3 Application and Practicality

The third theme, application and practicality, examines the impact case studies, practical examples, and knowledge assessment have on the competence and confidence of dietetic professionals. It consists of two subthemes: case studies and practical examples, as well as knowledge assessment. This theme highlights the importance of real-world application, practical examples, and knowledge assessment in enhancing the confidence and competence of dietetic professionals.

Case studies and practical examples

In this subtheme, we will examine how case studies and practical examples impact dietetic professional confidence and competence. In the third module on the ICDA website, several case studies were featured, which showcased examples from various regions worldwide where nutrition and sustainability were integrated into practice. These case studies aim to inspire dietetic professionals to adopt SFS in their own practice settings. Additionally, the second and

third learning modules provided a list of practical strategies for dietetic professionals to integrate SFS into their practice.

Regarding the case studies, one participant remarked, *"I thought that the case studies and the tools were very useful. I found them to be very diverse"* (P6). Another participant said that they found the case study helpful, as in their practice, they are often asked how dietitians can incorporate SFS in other areas of practice. So, the case studies provided them with examples they could share and refer people to. Similarly, another participant found the case studies stimulating as they offered valuable ideas about integrating SFS into different contexts.

While some participants found the case studies beneficial, others were dissatisfied, primarily due to a lack of clarity and relevance to their practice. One participant noted that the case studies were difficult to follow and lacked structure, which hindered their understanding.

Another participant had this to say: *"In the 3rd module, the case studies felt too narrow, and if they didn't align with my work, they didn't seem useful. Because they were so narrow, there were fewer bigger ideas to take away and apply in another setting"* (P10). Several others, including, echoed this sentiment, stating that the case studies were not useful because they did not pertain to their area of practice. They went on to say that they might refer to the case studies in the future if they change their area of practice, but for now, they have no use for them. agreed, stating, *"For me, the case studies, like what* (P19) said, *are interesting but not necessarily going to be applicable in my practice"* (P3).

One participant who worked in clinical nutrition noted that it would be great if there were case studies and examples of how to incorporate SFS into clinical nutrition, especially in the cancer field where they work. They would like to know what other dietetic professionals have done in

that field. Other participants advocated for a variety of examples, ranging from short-term to long-term projects, to cater to different professional settings.

Some participants also questioned the broad scope and diverse origins of the case studies, questioning their relevance to their local practice in Canada. Participants in this study assessed the usefulness of the case studies based on their applicability to their specific contexts, acknowledging their value while highlighting their limitations to their practice area.

During the focus groups, participants emphasized the importance of having concrete examples of how to integrate SFS into practice. One participant remarked, *"I think learners would feel more confident, just getting a few more tangible examples of what it means to integrate sustainable food system into nutrition and dietetic practice"* (P2). For this participant and several others, having practical examples from other dietetic professionals can help build their confidence. Participants also noted that in the second module, they were provided with various examples demonstrating how dietetic professionals can integrate SFS into their practice. Several participants remarked that while the examples were beneficial, the sheer quantity was overwhelming, leading many to bypass them due to the information overload.

Overall, the data showed that case studies and practical examples are very important tools for confidence and competence. They enhance competence by showcasing diverse approaches to integrating SFS into practice, thereby expanding professionals' knowledge bases. Additionally, they boost confidence by demonstrating achievable strategies and fostering a sense of empowerment among professionals. The integration of case studies and practical examples into the learning environment for dietetic professionals is vital for enhancing competence and confidence. These real-world applications provide tangible examples of how SFS can be incorporated into practice, thereby increasing knowledge and skills. However, it is essential to

tailor these examples to be relevant and applicable to the diverse contexts in which dietetic professionals work. By doing so, these tools can effectively build confidence and competence, empowering professionals to implement sustainable practices in their field.

However, to maximize the effectiveness of case studies and examples, it is crucial to avoid overwhelming learners and ensure a range of examples tailored to different professional contexts. Furthermore, providing clear, step-by-step guidance on the application of these case studies and examples is essential.

Knowledge Assessment

In this subtheme, we will examine the role of knowledge assessment in enhancing dietetic professionals' confidence and competence. Knowledge assessment includes any tools used to gauge participants understanding, such as quizzes, tests, or open-ended questions. Currently, the ICDA modules lack any graded quizzes, tests, or questions for participants to evaluate their knowledge. In response, many participants noted the absence and stated the need for such assessments.

One participant highlighted the desire for more action-oriented assessments, such as quizzes or writing tasks, to help them gauge their newly acquired knowledge. Another participant mentioned that they were type A learner and they learn best if there is a way to test their knowledge. For this participant, knowledge assessment will help reinforce their knowledge and increase their competence. The absence of knowledge assessments left some participants feeling uncertain about their grasp of the material, impacting their confidence in SFS.

*"But I really love the test of your knowledge, so you can get some immediate feedback as to what you've maybe absorbed from what you've read or looked at in these modules"* (P16)**.** For many of

the participants, the ability to test their knowledge and receive feedback would not only aid their learning but also enhance it. Another participant suggested that having an opportunity to take sample questions that have clear, correct, and incorrect answers helps them check their understanding of the concepts.

In the previous theme, we discussed the potential of a discussion forum to enhance competence and confidence. One participant viewed a discussion forum as a means to check their understanding and track their progress. For this individual, simply learning the module content was insufficient; they needed a method to assess and validate their knowledge. For another participant who was an educator, the act of testing their knowledge served as a confidence booster. Using assessment to confirm their understanding instills confidence in this participant as it is a form of validation which empowers them with confidence to teach their students about SFS.

Having a knowledge assessment in the learning modules could enhance the competence of dietetic professionals by identifying areas for improvement and helping them focus their attention. Additionally, knowledge assessments can reinforce dietetic professionals' skills, enabling them to feel more confident in applying SFS in practice.

The theme of application and practicality emphasizes the crucial role that case studies, practical examples, and knowledge assessments play in bolstering the competence and confidence of dietetic professionals. These features contribute to the real-world application of SFS practices by providing context and practical insights that bridge theoretical knowledge and practical applications.

Case studies and practical examples offer valuable insights into integrating nutrition and sustainability into practice. While some participants found them varied and inspiring, others stressed the need for broader applicability and more specific, actionable examples tailored to their contexts. Despite these differences in opinion, case studies and practical examples can serve as drivers for learning that dietetic professionals can follow or adjust to their preference.

Furthermore, knowledge assessments were highlighted as an important tool for validating participants' understanding and reinforcing their confidence. Participants expressed a desire for quizzes, tests, and other forms of assessment to gauge their understanding of the material. These assessments not only help identify knowledge gaps but also provide feedback that supports long-term retention and application, enhancing both competence and confidence among dietetic professionals.

Overall, the application and practicality theme highlight the importance of bridging theory with practical examples in SFS education. By incorporating diverse, contextually relevant case studies and practical examples, coupled with effective knowledge assessment strategies, we can empower dietetic professionals to incorporate SFS confidently and competently into their practice. As we move forward, further research and refinement of these approaches will be essential to ensuring the continuous professional development and effectiveness of dietetic professionals in promoting SFS.

### 4.7 Discussion

This chapter examined the content and design features that are most effective in increasing competence and confidence among dietetic professionals. The results of the thematic analysis revealed that several content and design features play significant roles in enhancing dietetic

professionals' competence and confidence in SFS. Specifically, flexibility and self-directed learning, diverse learning styles, reflective learning, structured page layouts, interactive learning methods, and peer discussions with knowledge assessments were identified as key elements that influence dietetic professional competence. Similarly, case studies, practical examples, interactive learning activities, peer discussions, and knowledge assessments were found to enhance dietetic professional confidence.

A notable aspect of this study is the shared experiences between participants from Australia and Canada. Despite being from different regions, participants from both countries emphasized the value of flexibility and self-paced learning formats, which allowed them to manage their professional responsibilities while enhancing their competence. Participants in Canada, on the one hand, expressed a stronger preference for diverse content by pushing for the learning modules to have resources on Indigenous perspectives. Participants in Canada were also the ones who were concerned about the weight-biased content in the learning modules. Australian participants, on the other hand, pushed more for a discussion forum. These differences suggest that cultural or regional factors may influence dietetic professionals' learning preferences and should be taken into account when designing educational resources.

Our findings also highlighted the importance of practical examples and case studies tailored to the dietetic field. The results, unfortunately, do not touch on the long-term effect the module might have on the dietetic profession, pointing to the need for further study to determine the sustained effects of these educational strategies on professional practice.

Some of the findings, while promising, face challenges when examined in a broader context. For instance, the use of self-directed, flexible learning formats has been widely supported as effective in many studies (Mukhtar et al., 2020). However, other research indicates that these

formats may not work as well for learners who require more face-to-face interactions (Photopoulos et al., 2022). This highlights the potential limitations of a "one-size-fits-all" approach to learning, suggesting that educational modules need to offer a balance to cater to diverse learner needs.

This study also identified a gap between what is currently offered in the ICDA modules and what dietetic professionals desire. While participants appreciated the theoretical content, they expressed a need for more tailored, practical examples and knowledge assessment tools to gauge their progress.

In terms of application, the findings suggest that ICDA and similar organizations or training programs can enhance their educational courses by incorporating more peer discussion forums, practical examples and case studies, and knowledge assessments. These elements would increase engagement, foster deeper learning, and foster critical thinking, thereby improving the competence and confidence of dietetic professionals in SFS. The potential inclusion of these features would be consistent with the ICDA's global effort to promote sustainability in dietetics and nutrition.

Overall, this study contributes valuable insights into the content and design features that can enhance the competence and confidence of dietetic professionals in SFS. While flexibility, interactive learning, and practical examples are crucial, attention must also be given to regional preferences and the need for more social interactions for some learners. Moving forward, future research should aim to address these limitations and further explore how different educational interventions can support the professional development of dietetic professionals across diverse contexts and examine the long-term effect educational resources like the ICDA learning modules have on dietetic professionals' ability to incorporate SFS into practice.

## 4.8 Recommendations

Based on the various stakeholders identified in the first chapter, the following recommendations are drawn from the results of this research study. These are designed to assist educators, organizations, and training program developers in incorporating SFS.

Recommendations for Educators

1. Adopt Online Self-Directed Formats: Educators should consider utilizing online self-directed learning formats when teaching their students, as participants responded positively to this flexible and accessible approach.
2. Break Information into Manageable Units: Educators should present information in smaller, digestible units to improve knowledge retention and prevent knowledge overload.
3. Foster Discussion: Encourage peer-to-peer learning by promoting small group discussions, which can enhance knowledge exchange and understanding.
4. Cater to Diverse Learning Styles: Incorporate various teaching methods to accommodate different learning preferences, ensuring a more inclusive learning environment.

Recommendations for the ICDA

1. Offer Diverse Content: Provide diverse content, resources, and information from various sources to enhance participants' knowledge absorption.
2. Break Modules into Pages: Break down the modules into several pages to help participants keep track of their progress and focus on one topic at a time.

3. Facilitate Discussion Forums: Establish discussion forums on the websites or platforms to encourage interaction and collaboration among participants.
4. Include Practical Examples: Ensure that practical examples and case studies cover a broad range of scenarios, including both big projects and smaller-scale examples.

Recommendations for Training Program Developers

1. Incorporate Knowledge Checks: Use quizzes or knowledge tests throughout the program to assess understanding, ensuring participants grasp key concepts.
2. Consider Non-Graded Quizzes: To reduce pressure on participants, make quizzes non-graded, promoting a focus on learning rather than performance.
3. Facilitate Discussion Forums: Establish discussion forums on websites or platforms to encourage interaction and collaboration among participants.
4. Include Practical Examples: Ensure that practical examples and case studies cover a broad range of scenarios, including both big projects and smaller projects.

The goal of this recommendation is to improve the effectiveness of educational programs by enhancing participant engagement and promoting a conducive learning environment.

### 4.9 Strengths and Limitations of the Study

This section outlines the strengths and limitations of the research study, acknowledging the methodological soundness while highlighting areas for improvement.

Strengths: A major strength of this study is its potential to inform the development of training programs for dietitians and health professionals. By identifying specific areas where competence and confidence in SFS can be enhanced, the findings provide a foundation for designing targeted

interventions to improve professional practice. This research also makes a valuable contribution to future studies, offering insights for further investigation into the effectiveness of educational interventions in this area.

Additionally, the thematic analysis employed in the study enabled a deep exploration of participants' experiences and perspectives, providing rich, qualitative data on the content and design features that influence competence and confidence among dietetic professionals. These insights are particularly important as they allow for a more nuanced understanding of how learning modules can be designed to be most effective.

Limitations: One of the study's key limitations is the challenge of generalizability, which is influenced by both the sample size and geographic scope. While the study included 20 participants from Australia and Canada, the goal was not to generalize findings to the entire population of dietitians or the broader Canadian and Australian populations. Instead, this study focuses on dietitians who are already interested in learning about SFS and would seek out related educational materials. This purposeful sampling strategy ensures that the findings are relevant to this specific group, and the sample size is appropriate for that purpose. However, the findings may not be generalizable to dietitians from other countries or those without a prior interest in sustainability.

The geographical limitation of including only participants from Australia and Canada introduces potential bias, as dietitians' cultural and environmental contexts in non-Western nations may differ significantly. The study's findings may, therefore, not apply to dietitians from diverse cultural backgrounds where dietary, socioeconomic, and environmental factors are different.

Future research should seek to address these limitations by expanding the sample to include a more diverse range of participants from different countries and cultural contexts, thus enhancing the generalizability of the findings.

### 4.10 Conclusion

This study demonstrates that key content and design features within educational programs can significantly enhance the competence and confidence of dietetic professionals in applying SFS principles to their practice. Flexibility in learning formats, the use of diverse content and learning styles, and a well-structured layout were identified as vital for increasing competence. The study also highlighted the importance of reflective learning, interactive experiences, and peer discussions as tools for fostering both competence and confidence.

Importantly, participants expressed a strong desire for more practical, case-based examples tailored to their specific practice settings. These real-world applications are crucial for helping dietetic professionals bridge the gap between theory and practice, enabling them to confidently integrate SFS into their daily work. While the current learning modules offered valuable insights, there are still opportunities to tailor these resources to meet the evolving needs of dietetic professionals.

In summary, this research highlights the importance of designing educational interventions that not only impart theoretical knowledge but also emphasize engagement, interaction, and practical application. Future efforts should focus on refining these approaches, ensuring that dietitians are equipped with the confidence and competence to drive sustainability in their professional practice. These findings lay the foundation for more targeted, practical, and interactive learning modules that can continue to advance the role of dietitians in promoting SFS.

# Chapter 5: Discussion

## 5.1 Introduction

This master's thesis project is a pilot study that explored the models and approaches used to train dietetic professionals to effectively incorporate Sustainable Food System (SFS) into their practice. Specifically, it examined how the three learning modules available on the International Confederation of Dietetic Associations (ICDA) website build competence and confidence in SFS among dietetic professionals.

Dietetic professionals play a crucial role in creating a SFS, yet research shows that many lack the knowledge and training needed to incorporate SFS into their practice (Guillaumie et al., 2020). In response to this need, the ICDA created three learning modules to educate and train dietitians about SFS, aiming to help them integrate these concepts into their practice.

There were two overarching research questions guiding this study:

1. How, if at all, do the ICDA online learning modules increase dietetic professionals' confidence and competence with sustainable food systems?
2. What content or design features are most effective in increasing dietetic professionals' competence and confidence?

This research contains two research studies, with each study answering each of the research questions. The first research question was answered using a mixed-methods approach. Participants completed two surveys: a baseline survey and a three-month follow-up survey. The open-ended survey responses and the focus group data were analyzed using Braun and Clarke's thematic analysis method.

The second research question was primarily addressed through a qualitative study, using focus group data analyzed with Braun and Clarke's (2006) thematic analysis method.

This thesis comprises five chapters. The introductory chapter introduces SFS, the role of dietetic professionals, and the significance of their contributions to building SFS. The second chapter examines existing literature on SFS and dietetic practice, summarizing key papers up to the time of writing. The third chapter is a result section on how the ICDA modules increased the competence and confidence of dietetic professionals in SFS. The fourth chapter is a result section that analyzes the content and design features of the modules that increased dietetic professionals' competence and confidence in SFS. This chapter is a discussion chapter summarizing the previous chapters.

### 5.2 Key Results

The first results chapter investigated how the learning modules increase dietetic professionals' confidence and competence in SFS. This mixed-methods research study, which incorporated both surveys and focus groups, identified two main outcomes: increased competence and increased confidence. The first outcome demonstrated that participants' knowledge of food systems, sustainable diets, social sustainability, and environmental sustainability improved after completing the modules, enhancing their competence. The second outcome showed that participants' readiness and confidence to incorporate SFS into their practice increased after engaging with the learning modules.

The second result chapter examined how the content and design features of the ICDA learning modules can enhance dietetic professionals' competence and confidence. From the thematic analysis, three themes emerged: learning environment and approach, engagement and

interaction, and application and practicality. The first theme, learning environment and approach, indicated that flexibility, self-directed learning, diverse learning styles and content, and a structured layout positively affected the competence of dietetic professionals. The second theme highlighted the importance of reflective learning, interactive learning, and peer discussion in boosting both competence and confidence. The third theme highlighted the importance of having case studies, practical examples, and knowledge assessments to increase the competence and confidence of dietetic professionals.

This discussion chapter will delve deeper into these findings and connect them to existing literature.

### 5.2.1 Key Results: Increased Competence

Food systems and sustainable diets.

Survey results indicated a significant increase in participants' knowledge levels after engaging with the learning modules. Specifically, the modules were found to enhance most participants' understanding of food systems and sustainable diets. Thematic analysis from focus group discussions further supported these findings, revealing that participants could articulate detailed and accurate definitions of sustainable diets and food systems after completing the modules showing their understanding of this SFS principle. This demonstrated a heightened level of comprehension and proficiency on the topic.

Social sustainability and environmental sustainability

Conversely, participants initially exhibited less familiarity with social and environmental sustainability compared to food systems and sustainable diets. Prior to the modules, many expressed a desire to deepen their knowledge in these areas. After completing the learning

modules, the survey data indicated an increase in participants understanding of social and environmental sustainability. However, some participants did not attain the highest level of knowledge in social sustainability, highlighting the need for continued educational efforts in this area.

During the focus group discussions, participants appreciated the inclusion of social and environmental sustainability topics within the modules. They noted that the modules served as a reminder of the multifaceted nature of SFS that include social and environmental aspects. This feedback, alongside the survey results, suggest that the modules positively impacted participants' knowledge in these areas. Nonetheless, in the three-month survey, participants expressed a continued interest in learning more about social sustainability.

To optimize effectiveness, future iterations of the learning modules should incorporate additional resources and information specifically addressing social sustainability. This aligns with Vallance et al.'s (2011) research, which highlights the underrepresentation of social sustainability in sustainability discourse. The absence of attention to social sustainability aspects, such as discriminatory or colonial ways of thinking, may have caused one participant to disengage with the module, particularly due to the content on weight bias. This highlights the importance of integrated sustainability thinking, which is necessary to minimize potential harm and ensure a more inclusive, full-systems approach. Emphasizing the importance and components of social sustainability could further enhance participants' comprehensive understanding of SFS, thereby advancing their competence in dietetic practice.

In conclusion, the study's findings note the educational value of incorporating diverse sustainability topics into training modules. By enhancing professionals' knowledge of food systems, sustainable diets, and social and environmental sustainability, these modules play a

crucial role in equipping dietetic professionals with the necessary skills to promote sustainable practices within their professional contexts.

### 5.2.2 Key Results: Increased Confidence

Readiness

Readiness can be defined as the state of preparedness or willingness to take action, often influenced by acquired knowledge and skills (Chorrojprasert, 2020). In the context of this study, readiness pertains to dietetic professionals' readiness to integrate SFS principles into their practice.

The results from the survey and focus group discussions indicated an increase in participants' readiness to incorporate SFS into their practice after engaging with the learning modules. This demonstrates that the learning modules play an important role in enhancing the readiness of dietetic professionals, preparing them to apply SFS concepts in their professional settings effectively.

This is supported by work by Spiers and colleagues (2010) who found that educational programs can significantly enhance professionals' readiness to adopt new practices or integrate new knowledge domains into their work. Spiers et al.'s (2010) study used context-based learning to prepare nursing students, noting that the more confident and ready nurses felt, the more effectively they were able to perform in their professional practice. Similarly, in our study, the ICDA learning modules incorporated practical, context-relevant examples of SFS in dietetic practice. This aligns with Spiers et al.'s (2010) findings by showing that context-based learning

helps professionals see how abstract concepts can be applied in real-world situations, enhancing their readiness to act.

Context-based learning is using real-life examples to teach about a problem (Overton, 2016). By providing real-world examples through the case studies, the ICDA modules may have served as a form of context-based learning for dietetic professionals, fostering a deeper connection between theory and practical application. This helps explain why participants reported increased readiness—just as nurses in Spiers et al.'s (2010) study became more prepared for practice through context-specific learning, so too did dietetic professionals in our study. The modules' practical focus could have played a crucial role in bridging the gap between knowledge and readiness, making SFS principles more applicable and actionable within dietetic practice.

The ICDA learning modules have proven effective in increasing dietetic professionals' readiness to incorporate SFS into their practice. This increased readiness is crucial in helping dietetic professionals effectively integrate SFS principles, enhance their overall practice, and contribute to more sustainable health outcomes.

### Confidence

Confidence is crucial in professional practice, particularly in fields such as dietetics, where practitioners must apply complex principles like SFS. Confidence, in this context, refers to dietetic professionals' belief and self-assurance in their ability to successfully implement these principles in their practice (Budin, 2017).

Research has shown that educational programs can increase confidence among professionals. For instance, a study by Abdelkader et al. (2021) demonstrated that increasing self-confidence in

student nurses equips them to provide better care to their patients. This study analyzed fourth-year nursing students and found that their self-confidence grew significantly due to their university educational program, which included a combination of structured academic learning, hands-on clinical experience, and targeted training practices. The integration of theory and practical application allowed the students to build their self-confidence, which translated into improved performance and outcomes in their field (Abdelkader et al., 2021).

These findings can be extrapolated to dietetic professionals, suggesting that similar educational interventions, such as the ICDA learning modules, may help increase confidence in applying SFS principles into practice. The ICDA module case studies, much like the clinical experiences in nursing education, provide dietetic professionals with practical, context-based learning opportunities, allowing them to apply theoretical SFS concepts to their real-world practice. This blend of knowledge acquisition and practical application likely plays a critical role in building confidence, as it did for nursing students in Abdelkader et al.'s (2021) study, thus preparing dietetic professionals to better integrate sustainability into their practice.

Further supporting this, Spiers et al. (2010) conducted research on how context-based learning in nursing education improved the readiness and confidence of nursing students. Although this study focused on nursing, the parallels with dietetics are evident. Context-based learning, like the case studies in the ICDA module, gives dietetic professionals real-life examples and situations to help them gain confidence and skills (Spiers et al., 2010). This highlights the importance of educational programs in preparing professionals to adopt new practices and integrate new knowledge into their practice.

Our research study's survey results and focus group discussions showed that participants felt more confident after completing the ICDA modules. This increased confidence suggests that the

modules not only improved their knowledge but also empowered them to apply SFS principles effectively.

In conclusion, the literature examined supports the idea that educational programs, especially those rooted in real-world applications, play a crucial role in boosting professional confidence. The ICDA learning modules have proven to be effective in helping dietetic professionals incorporate sustainable practices and contribute to the broader goal of promoting sustainability in dietetics.

### 5.2.3 Key results: Learning Environment and Approach

This study found that the flexible structure and diverse learning styles accommodated by the ICDA modules significantly enhanced participant engagement. The first theme, learning environment and approach, includes flexibility and self-directed learning, diverse learning styles and content, and structured layout.

Flexibility and self-directed learning

The thematic analysis revealed that many participants appreciated the flexibility of the online modules and the ability to learn at their own pace. This flexibility and self-directed learning played a significant role in enhancing their competence. A study by Mukhtar et al. (2020) supports these findings, highlighting the advantages, limitations, and recommendations for online learning. Their research indicated that online learning is flexible and effective, offering benefits such as easy accessibility, convenience, and increased self-directed learning. They found that self-directed learners tend to acquire more knowledge than traditional classroom learners. This aligns with our findings, suggesting that the ICDA learning modules, by being online and flexible, can enhance the competence of dietetic professionals in SFS.

Diverse learning styles and content

The second subtheme emphasized the importance of incorporating diverse learning styles (visual, auditory, and kinesthetic) and varied content to enhance participants' competence. Learning styles refer to individuals' preferred methods to process new information effectively (Huston & Huston, 1995). Visual learners absorb information through images, auditory learners excel with verbal instructions, and kinesthetic learners thrive with physical engagement (Huston & Huston, 1995). Goa Yotta (2023) highlighted the importance of incorporating diverse learning styles to facilitate student learning, noting that failure to do so can result in lower comprehension and understanding. This research underscores the significance of diverse learning styles in increasing dietetic professionals' knowledge, skills, and competence.

Structured layout

The third subtheme, structured layout, revealed that the layout of a page can significantly affect participants' absorption and comprehension of information. A cluttered page, poorly presented information, or difficult navigation can hinder understanding and reduce competence. Ambrose et al. (2010) suggests that presenting too much information at once can overwhelm learners due to cognitive load. They recommend helping students manage this cognitive load by allowing them to focus on one small chunk of information at a time, thereby enhancing learning efficiency (Ambrose et al., 2010). This underscores the importance of a well-structured layout in online learning environments to improve competence.

By aligning the study’s findings with existing literature, this discussion validates the ICDA learning modules' positive impact on dietetic professionals' competence. This thesis suggests that optimizing dietetic professionals' learning environment and approach by offering flexibility, self-

directed learning, diverse learning styles and content and having a structured layout is crucial for enhancing dietetic professional's competence and readiness to incorporate SFS into their practice.

### 5.2.4 Key Result: Engagement and Interaction

The second theme, engagement and interaction, comprises two subthemes: reflective learning and interactive learning with peer discussion.

Reflective learning

The first subtheme, reflective learning, highlights reflection's crucial role in deepening participants' understanding. The analysis revealed that reflective questions encourage participants to pause and absorb the information they receive, significantly enhancing their competence in SFS. Reflective questions were particularly important for prompting participants to fully understand and internalize what they had just learned.

For example, in the third module, several questions about the ICDA modules prompted participants to actively participate in their learning, a method supported by Yotta's 2023 research paper, which noted that engaging learners through activities is an effective way to enhance understanding and build competence.

A 2019 study by Chang examined the impact of reflection on learning, particularly in an online setting. The results indicated that reflective questions at the end of each lesson significantly enhanced students' learning, helping them understand the interconnectedness of the material (Chang, 2019). Chang also noted that reflective questions allowed learners to contextualize and personalize their learning, thereby increasing their knowledge and skill development. Chang recommends that effective teaching should include reflective questions.

Another 2019 study by Liu Yuliang explored the impact of reflections on learners' abilities in an online graduate class. The findings showed that reflections are a highly effective teaching method, engaging learners and promoting deeper understanding (Liu, 2019). This method enabled students to connect their learning with personal experiences and challenged their thinking, leading to higher-order learning.

Applying these insights, participants become more confident in applying their knowledge to practice after applying reflective exercises. Ambrose and colleagues (2010) noted that for effective learning, students must link acquired knowledge to real-life applications. Without these connections, knowledge remains inactive and impedes learning progress. The inclusion of reflective questions ensures that knowledge remains active, facilitating skill development and understanding, thus contributing to the competence of dietetic professionals. Given these insights, incorporating reflective questions or a reflection section is essential for increasing the competence of dietetic professionals.

Interactive learning and peer discussion

The second subtheme is interactive learning and peer discussion. The thematic analysis revealed that enabling participants to engage with each other through discussion forums or other avenues increases their competence by deepening their understanding and facilitating mutual learning. Moreover, interactive learning and peer discussions also positively impact participants' confidence. Allowing participants to connect and share their experiences in incorporating SFS into their practice can inspire and boost the confidence of other dietetic professionals to do the same.

The 2019 study by Chang also emphasizes the importance of student interactions in enhancing learning. The research highlighted that when students read and reflected on each other's blog posts, they provided meaningful feedback and helped each other improve. This interaction facilitated the sharing of ideas and introduced students to new perspectives, enhancing their knowledge (Chang, 2019). Furthermore, these interactions enabled students to identify similarities and differences in their work, leading to the development of various approaches to tasks. This collaborative environment increased students' metacognitive knowledge, critical thinking, and knowledge acquisition (Chang, 2019). This research supports the notion that discussion forums or interactive platforms significantly enhance knowledge and competence among dietetic professionals.

Similarly, a 2022 study by Ahmed Gasmi examined the impact of online discussion forums on students' learning. The findings revealed that these forums enhanced students' critical reading and thinking skills. Participation in online discussions also increased students' engagement and confidence in the subject matter (Gasmi, 2022). This study reinforces the idea that interactive learning environments are crucial for developing critical skills and confidence.

Another relevant study, conducted in 2021 by Aderigibge, investigated whether online discussions facilitate deep learning. The results demonstrated that online discussions improved student learning, confidence, and participation. The study concluded that online discussions are a valuable complementary learning approach that enhances overall learning outcomes (Aderigibge, 2021).

These research studies collectively validate the significant role of interactive learning and peer discussion in enhancing the competence and confidence of dietetic professionals. They highlight the importance of incorporating discussion forums and interactive sessions in e-learning modules

to foster a more effective and supportive learning environment. Participants in this pilot study echoed these findings, emphasizing the value of peer discussion and interactive learning activities. They reported that these elements helped them better understand the material, apply it to real-world situations, and feel more confident in their abilities to incorporate SFS into their practice. The absence of a discussion forum or interactive sessions is a significant shortfall in the ICDA modules. Therefore, incorporating interactive e-learning and peer discussions is essential for increasing dietetic professionals' competence and confidence. The ICDA learning modules would be better improved by introducing a discussion forum.

### 5.2.5 Key Result: Application and Practicality

The third theme, application and practicality, had two subthemes: case studies, practical examples, and knowledge assessment.

Case studies and practical examples

The first subtheme, case studies and practical examples, emphasizes the value of diverse case studies and practical examples from various regions and circumstances in enhancing dietetic professionals' competence in SFS. These tools offer practical ideas and demonstrate achievable strategies, thereby boosting professionals' confidence in integrating sustainable practices into their work.

A 2017 study by Fawcett explored the impact of case studies on student performance, revealing that students engaged in case study-based learning demonstrated higher levels of engagement, received more positive feedback, showed greater initiative, and achieved higher grades compared to a control group. The case study group participants also exhibited enhanced learning outcomes and professional skill development (Fawcett, 2017).

Similarly, a 2020 study by Huang and colleagues investigated the role of example-based learning in addressing self-efficacy issues in online statistical learning. The study found that practical examples and case studies significantly facilitated learning outcomes, enhanced effectiveness, and fostered confidence and positive attitudes among learners. This research highlights the importance of using practical examples and case studies to increase self-efficacy (Huang et al., 2020).

Overall, case studies and practical examples are essential tools for building both competence and confidence. They enhance competence by showcasing diverse approaches to integrating SFS into practice, thus expanding professionals' knowledge bases. Additionally, they boost confidence by demonstrating achievable strategies and fostering a sense of empowerment among professionals. By incorporating more case studies and real-world examples, the ICDA modules can provide dietetic professionals with practical insights and enhance their ability to integrate SFS into their practice.

However, to maximize the effectiveness of case studies and examples, it is crucial to avoid overwhelming learners and ensure a range of examples tailored to different professional contexts. Providing clear, step-by-step guidance on the application of these case studies and examples is also essential. Case studies from various professional contexts should be used, including clinical, community, and public health settings. These practical examples can help participants relate the learning material to their specific work environments, thereby enhancing the applicability of the content (Fawcett, 2017). This structured approach ensures that dietetic professionals can effectively translate theoretical knowledge into practical, actionable strategies in their work without feeling overwhelmed.

Knowledge assessment

Existing literature often lacks studies specifically addressing the impact of knowledge assessments on confidence, with most consensus suggesting a negative effect. However, a paper by Meer and Chapman (2014) examined the effect of low-stakes assessments on student knowledge. Their research showed that low-stakes assessments not only increased students' confidence but also improved their knowledge retention. They found that process-based, rather than content-based, assessments reduced student anxiety and raised confidence. After engaging with low-stakes assessments, students reported increased knowledge and better knowledge retention.

Most studies indicate that knowledge assessments tend to lower students' confidence rather than increase it. Research has also discouraged using quizzes and tests to determine students' knowledge, deeming them ineffective for enhancing competence (Steenhuis et al., 2009).

Despite the absence of supporting research, this thesis study's data and participant feedback suggest potential benefits from knowledge assessments. While the literature generally contradicts my findings, it is important to note that most research focuses on student experiences rather than professional ones. There is a significant difference between tests that affect students' grades and those voluntarily taken by professionals without impacting their jobs.

The research by Meer and Chapman (2014) indicated that students' confidence and knowledge increased when low-stakes assessment options were used. For professionals, being able to take assessments and tests that do not affect their job might end up benefiting them. To ensure these assessments are low stakes, having them be optional, not tied to the dietitian's professional

evaluations and designing them for reflection and improvement in weak study areas. Doing this might eliminate any pressure typically associated with assessment.

Knowledge assessments could enhance the competence of dietetic professionals by identifying areas for improvement and helping them focus their attention. Regular knowledge assessments can be used to highlight specific knowledge gaps, allowing professionals to target their learning efforts more effectively. Additionally, based on the findings from the research study, knowledge assessments can be used to boost professionals' confidence by reinforcing their knowledge and skills. Successfully completing assessments can make professionals feel more confident in their ability to apply SFS in practice.

In conclusion, while existing literature presents a largely negative view of knowledge assessments in educational contexts, this study suggests that knowledge assessments could be beneficial when applied in a professional setting. They can be used to provide valuable insights into areas that require improvement and reinforce existing knowledge, ultimately enhancing competence and confidence among dietetic professionals.

### 5.3 Implications for Future Developments

While the ICDA learning modules effectively enhance dietetic professionals' confidence and competence in SFS, they should not be seen as the sole solution for ongoing professional development. The field of dietetics requires professionals who are well-versed in SFS and capable of integrating this knowledge into their practice seamlessly. To support continuous learning and skill development in this area, the development of a comprehensive Continuing Professional Development (CPD) program for dietetic professionals is essential.

Continuing professional development are widely utilized in the health sector to enhance professional practice through formal and informal educational activities (Samuel et al., 2020). These programs differ from the ICDA modules' short-term nature in that they provide sustained, ongoing learning opportunities that evolve alongside advancements in the field. While the ICDA modules offer an excellent foundation for initial competence and confidence building, they are not designed for long-term engagement or continuous skill improvement. In contrast, CPDs offer a structured framework for lifelong learning, ensuring professionals remain trained in incorporating emerging knowledge and practices into their work (Samuel et al., 2020).

Despite their importance, the literature review conducted for this study revealed a limited availability of CPDs specifically focused on SFS within the dietetic field, leaving a gap that the ICDA modules alone cannot fill. Research maintains that CPDs are most effective when they are interactive and utilize online platforms, making learning accessible and less time-consuming for professionals (Main & Anderson, 2023). This feature not only enhances knowledge acquisition but also encourages deeper engagement and application of learning in real-world contexts. Moreover, mandatory CPD requirements in healthcare fields have been shown to motivate health professionals to continually improve their skills and knowledge (Main & Anderson, 2023).

Unlike the ICDA modules, which provide foundational knowledge in a relatively brief, self-contained format, a dedicated CPD program would provide ongoing support for dietetic professionals throughout their careers, equipping them with the tools and knowledge needed to continually incorporate SFS into practice. Interactive learning components such as case-based learning, demonstrations, and feedback sessions are crucial for maximizing the impact of CPDs on professional development and fostering long-term professional growth (Main & Anderson, 2023).

In conclusion, while the ICDA learning modules play a vital role in addressing the immediate knowledge and confidence gaps among dietetic professionals, a robust CPD program is essential for the long-term sustenance and enhancement of dietetic professionals' ability to integrate SFS effectively. CPDs can ensure that dietetic professionals maintain and expand their competence in SFS throughout their careers, offering a more comprehensive and continuous approach to professional development. By integrating these elements, dietitians will be better equipped to lead in promoting sustainable food practices within their professional contexts.

### 5.4 Recommendations

The findings of this study offer several valuable recommendations for improving the training of dietetic professionals in SFS. A key suggestion is to integrate flexibility and self-directed learning into training programs, accommodating the varied schedules and learning preferences of professionals. By offering self-paced modules and personalized learning pathways, programs can better meet individual needs, ultimately enhancing both competence and confidence in applying SFS principles.

Additionally, the study highlights the importance of incorporating diverse instructional methods to cater to different learning styles. Professionals process information in varied ways, so incorporating multimedia resources, interactive activities, and real-world case studies can provide a more engaging and comprehensive learning experience. This diversity in content delivery can support a deeper understanding and facilitate the practical application of SFS concepts.

A focus on real-world relevance and hands-on application is essential for improving competence. Integrating practical exercises and case studies directly into the learning modules enables dietetic

professionals to apply the theoretical knowledge in their daily lives. This approach not only reinforces learning but prepares participants to address challenges encountered in real-world settings, effectively bridging the gap between theory and practice.

Engagement and interaction are also critical to successful training. The study suggests incorporating interactive elements such as group discussions, peer collaboration, and virtual forums to encourage active participation. These opportunities for dialogue and knowledge-sharing can foster a more supportive and dynamic learning environment where professionals benefit from each other's experiences and perspectives.

Lastly, establishing a CPD program focused on SFS would provide an ongoing resource for dietetic professionals. Such a program could play a significant role in helping professionals integrate sustainability into their practice, keeping them updated on emerging trends and best practices.

In conclusion, while these recommendations can support the development of more effective and comprehensive training programs for dietetic professionals in SFS, it is important to acknowledge the complexity of SFS. The ICDA modules, though beneficial for many dietetic professionals, were not universally effective. This highlights the need for training programs to not only prioritize flexibility, diverse learning approaches, practical application, and interactive engagement but also to consider the varied experiences and professional contexts of dietitians. Future training programs should aim to be adaptable and responsive to different learning needs and practice environments, ensuring that they are relevant and accessible to a broader audience of dietetic professionals. By addressing these nuances, professional development programs can better align with the evolving demands and challenges in the field of dietetics and SFS.

### 5.5 Strengths and Limitations

Many strengths and limitations specific to each study have already been discussed in Chapters 3 and 4. One significant strength of this research lies in its contribution to the emerging field of SFS within dietetic practice. By exploring the impact of educational interventions on dietetic professionals' confidence and competence, this study provides valuable insights for future training programs and curriculum development. The qualitative nature of the pilot study enabled an in-depth exploration of participants' experiences, providing rich data that can guide further research. Additionally, the mixed-methods approach, incorporating baseline and three-month surveys alongside the focus group discussion, allowed for the assessment of changes in participants' competence and confidence over time, offering an extensive understanding of the effectiveness of the ICDA learning modules.

However, several limitations must be acknowledged. The small sample size, while appropriate for a qualitative pilot study, limits the generalizability of the quantitative findings. With fewer than 25 participants from Australia and Canada, the results may not be representative of dietetic professionals in other regions, especially those with different cultural, dietary, environmental, and socioeconomic backgrounds. The greater availability of resources on SFS in Western countries likely influenced the development of the resources, examples, and content on the ICDA website. As a result, the materials reflect a predominantly Western perspective, which may limit their relevance to non-Western contexts.

Another limitation is the reliance on self-reported data, which introduces potential biases such as social desirability and recall biases, affecting the accuracy of participants' reported confidence and competence (Latkin et al., 2017). The limited number of survey questions may not have captured the full scope of participants' experiences and learning outcomes. Furthermore, the six-

month gap between the baseline and three-month surveys could have impacted participants' recall, potentially influencing the accuracy of reported changes in knowledge and confidence. The study also does not explore the long-term sustainability of practices adopted by participants after completing the ICDA learning modules, leaving questions about whether the acquired knowledge and skills will be consistently applied over time.

This study's focus on dietetic professionals training in SFS also does not account for the diversity of roles within food systems, potentially limiting the broader applicability of the findings. By not delving into the impact of cultural and socioeconomic factors on the adoption of sustainable practices, we are potentially overlooking significant nuances.

Despite these limitations, the study provides a foundational understanding of the potential impact of training programs on dietetic professionals. Future research should aim to address these limitations by expanding sample sizes, exploring diverse cultural perspectives, and investigating the long-term sustainability of the practices learned.

### 5.6 Conclusion

Our planet is facing significant environmental challenges, and the promotion of SFS is a critical component in addressing these issues (Zinsius, 2013). Dietetic professionals are uniquely positioned to influence food choices and practices that contribute to sustainability (Spiker et al., 2020). However, to fulfill this role effectively, they require adequate training and support (Heidelberger et al., 2017). ICDA has developed online learning modules to provide this support, aiming to enhance dietetic professionals' competence and confidence in applying SFS principles.

Despite their potential, these modules cannot function effectively in isolation. The impact of such educational interventions might not be long-lasting if they are not part of a broader, ongoing

professional development strategy. Continuous reinforcement, practical application opportunities, and a supportive professional network are essential to ensuring that the benefits from these modules are sustained over time.

Addressing the research questions

This research has addressed the two overarching questions guiding the study:

1. **How, if at all, do the ICDA online learning modules increase dietetic professionals' confidence and competence with sustainable food system?**

The research findings indicate that the ICDA online learning modules increase dietetic professionals' confidence and competence in SFS. Survey results and focus group discussions highlighted substantial improvements in participants' self-reported knowledge and confidence levels after completing the modules.

2. **What content or design features are most effective in enabling increased competence and confidence among dietetic professionals?**

The study identified several key features that contribute to effective learning outcomes. These include integrating flexibility and self-directed learning options, diverse learning styles and content, practical application through real-world examples, and fostering engagement through interactive activities. These elements help tailor the learning experience to individual needs, thereby enhancing both competence and confidence among dietetic professionals.

In summary, this thesis has demonstrated that the ICDA online learning modules are an effective tool for enhancing the competence and confidence of dietetic professionals regarding SFS. However, these modules should be integrated into a comprehensive, ongoing professional

development framework that includes continuous learning and support for lasting impact. This approach will better equip dietetic professionals to contribute to SFS and address our planet's pressing environmental challenges.

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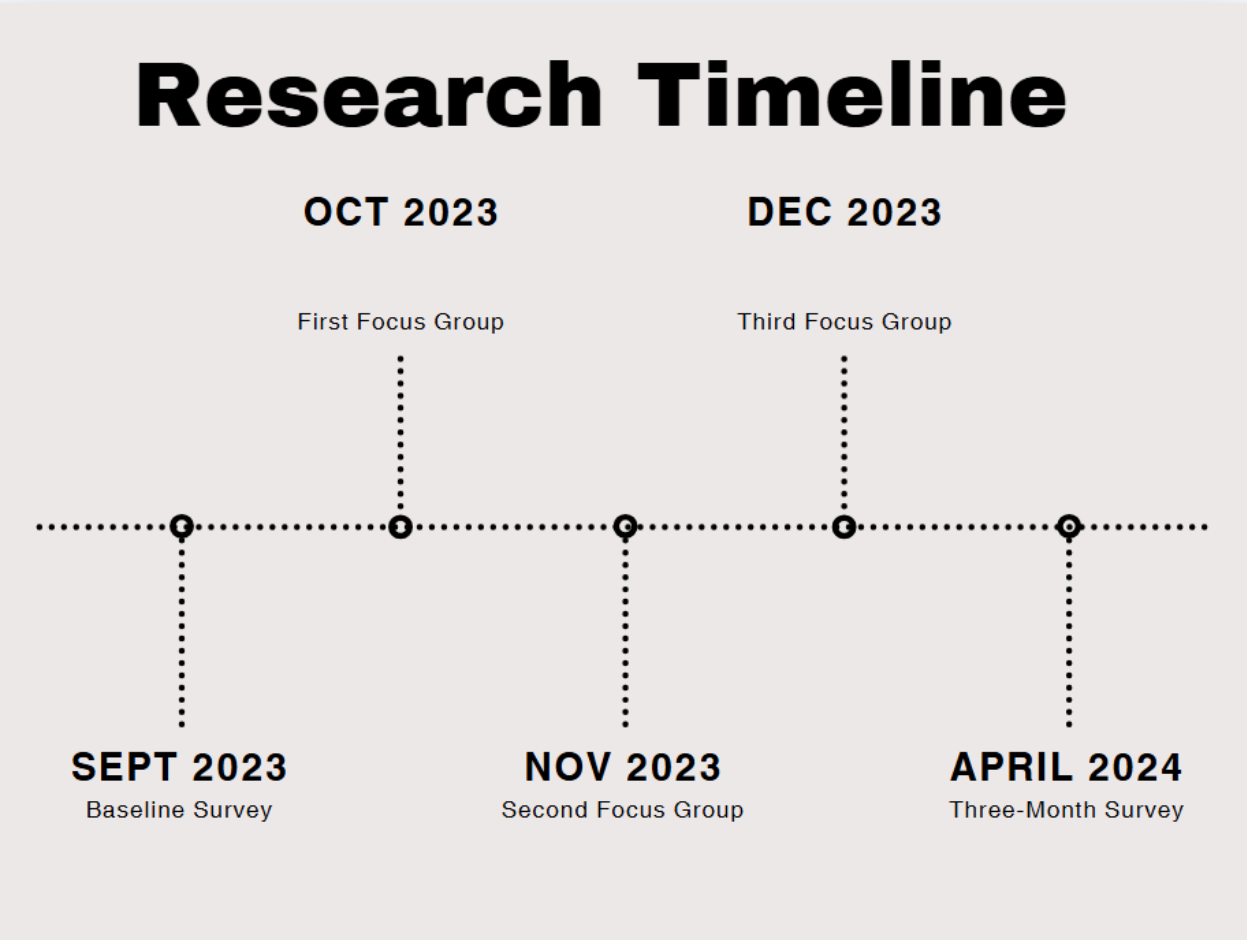
## Appendices

### Appendix I: Research Timeline



**Appendix II: Focus Group Summary**

| Design Feature | Impact | Explanation |
|---|---|---|
| *Learning Environment and Approach* | | |
| 1. Flexibility and self-directed learning | Enhances competence and knowledge absorption. | Participants valued the flexibility of the online format, allowing them to work at their own pace, pause videos for reflection, and focus on areas of interest or weakness. This deeper engagement led to improved understanding and application of SFS concepts. |
| 2. Diverse learning styles and content | Enhances engagement and retention. | Participants benefited from varied learning formats (visual, auditory, reading). A mix of resources, including SDG briefs and sustainability materials, helped provide a comprehensive understanding of SFS. |
| 3. Structured Layout | Improves comprehension and ease of use. | Breaking content into smaller sections with clear headings improved navigation and focus. A logical flow, clear objectives, and intuitive navigation were highly valued. |
| *Engagement and Interaction* | | |
| 4. Reflective learning | Supports deeper engagement and application. | Reflection prompts in the learning modules encouraged participants to apply learning to practice, reinforcing knowledge retention. |
| 5. Interactive learning and peer discussion | Encourages critical thinking and knowledge exchange. | Participants highlighted the value of discussion and interactive elements in reinforcing learning and broadening perspectives. |
| *Application and practicality* | | |
| 6. Case studies and practical examples | Supports real-world application. | Participants appreciated examples and case studies that connected SFS concepts to practical dietetic applications, making the learning more tangible and relevant. |
| 7. Knowledge Assessment | Reinforces learning and identifies gaps | Participants wanted quizzes or open-ended assessments to test and reinforce their learning which could further support learning retention and increase competence. |

## Appendix III: Recruitment Infographics

ACADIA UNIVERSITY | SCHOOL OF NUTRITION AND DIETETICS

MEMORIAL UNIVERSITY

# EXPLORING MODELS AND APPROACHES FOR TRAINING SUSTAINABLE FOOD SYSTEMS IN DIETETIC PRACTICE: A PILOT STUDY

**The purpose of this research is to explore a broad research question: What training models and approaches effectively support dietetics practitioners' competence and confidence in integrating sustainability into practice?**

### INTRODUCTION

- A Sustainable Food System (SFS) is a food system that ensures hunger and malnutrition are reduced, environmental sustainability is increased, and the earth's biodiversity is not compromised (Meybeck & Gitz, 2017).
- SFS is important because they will change our current production system by ensuring we lower our food waste and produce enough food to meet all Canadians' needs (Bajzelj et al., 2020).

### OBJECTIVES

- The primary objective of this research is to examine how the 3 International Confederation of Dietetic Association (ICDA) online learning modules about sustainable food systems can increase dietitians' confidence and competency.
- The secondary objective of the research is to support the development of training and integrating sustainable food systems into dietetic practice.

### METHOD

Participants will pilot test online training modules and provide feedback through focus groups and surveys to evaluate their effectiveness.

### RATIONALE

Nutrition and dietetics professionals are essential for sustainable food systems because they are leaders in food, nutrition, and health. They can help households and institutions make sustainable food choices and are the most credible nutrition experts.

Phebe Oluwafemi, MSc Candidate, Memorial University of Newfoundland
Liesel Carlsson, Associate Professor, Acadia University
Rachel Prowse, Assistant Professor, Memorial University of Newfoundland

This project is funded by the Harrison McCain Emerging Scholars Awards, the Faculty of Pure and Applied Sciences Acadia and Memorial University of Newfoundland.

**Appendix IV: Recruitment Advertisement**

**Appendix V: First focus group guideline.**

**Module 1: What are Sustainable Food Systems and Diets?**

**Ice Breaker**

1. Please introduce yourself. Tell us your name, the city you work in, and the food that brings you joy or comfort.

**Outcome Evaluation Questions**

1. In your own words, describe sustainable food systems and diets.

   Prompt 1: If you were to explain this to someone else (e.g., a colleague), how would you do it?

   Prompt 2: What are the key concepts for sustainable food systems and diets?

2. Has your confidence in sustainable food systems changed after completing the first modules and watching the videos?

Prompt 1: Think about your confidence level before taking the first module and compare it to now. Have there been any changes in your perspective?

Prompt 2: If not, why not? If yes, how has it changed?

**Process Evaluation Questions**

2. Regarding the format of the first learning module, what did you find to be the most helpful?

Prompts: Think about the features such as videos, links, reflective questions, definitions, etc.
Prompt 2: Please tell us about your experience using these resources.

Prompt 3: Did you appreciate the online and self-directed format of the first learning module?

3. Regarding the format of the first learning module, what did you find to be the most challenging?
Prompt 1: Think about the features such as videos, links, reflective questions, definitions, etc.

Prompt 2: Did you appreciate the online and self-directed format of the first learning module?

What else do you think we should know about your experience after going through learning module 1?

**Appendix VI: Second focus group guideline**

**Module 2: How are Sustainable Food Systems and Diets Relevant to Nutrition and Dietetic Practice?**

**Ice Breaker**

1. In the chat box mention your favorite book and author.

**Outcome Evaluation Questions**

1. Can you describe some ways that sustainability can be relevant in your practice?

Prompt: Think about it on an individual or community-based level.

Prompt: How can you integrate sustainability into your practice?

Prompt: Are any of these ideas new since completing module 2?

2. Do you feel confident that you can identify some relevant ways to contribute to SFS/D through your work?

Prompt: Why or why not?

**Process Evaluation Questions**

1. Regarding the format of the second learning module, what did you find to be the most helpful?

Prompt: Did you appreciate the online and self-directed format of the learning modules?

Prompt 2: Please consider this question given the focus of the material you were provided within this module compared to module 1.

2. Regarding the format of the second module, what did you find to be the most challenging?

Prompt: Compared to the last module, what was difficult?

Prompt 2: Please consider this question given the focus of the material you were provided within this module compared to module 1.

3. What else do you think we should know about your experience after going through learning module 2?

**Appendix VII: Third focus group guideline.**

**Module 3: How to Contribute to Sustainable Food Systems and Diets in Your Practice**

**Ice Breaker**

1. In the chat box, mention your favorite movie and why.

**Outcome Evaluation Questions**

1. Were the tools in the third module useful in supporting your understanding and incorporation of sustainable food systems into your practice?
   Prompt: Can you describe other tools that help you incorporate SFS into your practice?
   Prompt 2: Can you share examples of how you can integrate the tools into your practice?

2. Did the examples and case studies provided in Module 3 contribute to building your confidence in incorporating SFS into your practice?

   Prompt 1: How does seeing examples and tools impact your confidence?

   Prompt 2: Are there specific case studies that resonated more with you?

3. Did the examples and case studies provided in Module 3 contribute to building your confidence in incorporating SFS into your practice?

   Prompt: Do you feel confident that you can apply what you've learned from each module to your practice?

**Process Evaluation Questions**

1. What are some other suggestions you have to improve the modules and the website?

Prompt: What are your final takeaways for improving the module?

Prompt 2: If you could change anything or add to the features and formats, what would it be?

## Appendix VIII Baseline Survey

# Sustainable Food Systems- Baseline Survey

Hello and welcome! We sincerely appreciate your willingness to participate in our survey. This initial survey serves as a pre-assessment/baseline survey, designed to gauge your current level of confidence and competency in sustainable food systems before you engage with the learning modules. We understand that your time is valuable, and we estimate that this survey will take approximately 10 minutes to complete. Thank you once again for your valuable time and participation. Let's begin the survey. If you need to resume later or exit the survey and clear your progress, those options will be available.

There are 8 questions in this survey.

## Demographic

**This section will prompt you to provide your name, region, and area of specialization.**

**Name:** *

Please write your answer here:

*Your name is required in order to link your responses in the survey and focus group. Please be assured that all the information collected during this study will be treated with the utmost confidentiality. To ensure the security of your data, all information will be stored in password-protected Google Drive folders that are accessible only to the research team. Your personal information will be handled in strict accordance with data protection regulations. Your privacy is of paramount importance to us. More detailed information regarding the handling of your personal data can be found in the consent form.*

---

**In which country do you live and work?** *

Choose one of the following answers

Please choose **only one** of the following:

- ◯ Canada
- ◯ Australia

---

**In what professional area do you practice (i.e., what is the focus of your practice)? Choose all that apply.** *

Check all that apply

Please choose **all** that apply:

- ☐ Clinical practice (acute care, ambulatory care, long-term care, medical nutrition therapy)
- ☐ Food and nutrition management (food service, administration)
- ☐ Population health (community nutrition, policy, programming)
- ☐ Food industry (sales, marketing, food product development)
- ☐ Education and research (academic roles, dietetic training, dietetic research)
- ☐ Specialized nutrition consultant (sports nutrition, other)
- ☐ Other:

---

## How many years have you practiced as a nutrition/dietetic professional? *

Choose one of the following answers
Please choose **only one** of the following:

- ◯ Less than 1 year
- ◯ 1 – 5 years
- ◯ 6 to 10 years
- ◯ More than 10 years
- ◯ Prefer not to say

## Dietetic Practice

**In this next section, we would like to assess your level of knowledge on specific topics as well as your readiness to incorporate this knowledge into practice. Please rate your perceived knowledge on each of the following topics that are related to sustainable food systems using the provided scale. Next, consider the topic as a whole, and indicate how ready you are to incorporate this into practice.**

**How knowledgeable are you about the following topics?**
*

Please choose the appropriate response for each item:

| | I am new to this topic (I want to know more background information about this concept/topic area) | I have a good working knowledge of sustainability concepts/topics (I want to understand the relevance of this topic area to my practice) | I have a good understanding of the concepts/topics and their relevance to my practice (I want to know more about how to implement this topic area into my practice). | I do not know. |
|---|---|---|---|---|
| Food systems; which includes the people, institutions, companies, and infrastructures involved in food. | ◯ | ◯ | ◯ | ◯ |
| Social sustainability; which includes culture, economy, equity, gender and sovereignty. | ◯ | ◯ | ◯ | ◯ |
| Environmental sustainability; which includes biodiversity, climate change, energy use, land, water and food waste. | ◯ | ◯ | ◯ | ◯ |
| Sustainable diets. | ◯ | ◯ | ◯ | ◯ |

**Please describe your readiness to incorporate sustainable food systems principles into your dietetic practice.**

*

Choose one of the following answers
Please choose **only one** of the following:

- ◯ I am not even thinking about it.
- ◯ I have been thinking about it, but don't know where to start.
- ◯ I have been thinking about it and am actively gathering resources, and planning.
- ◯ I recently started testing out sustainable food system principles in my practice.
- ◯ I actively and regularly apply sustainable food system principles in my practice.
- ◯ I have embedded sustainable food system principles in most or all aspects of my practice.

## Confidence

**Sometimes knowledge and readiness to act can be influenced by our confidence in ourselves. We know that confidence in their ability to apply sustainable food systems is a barrier for many dietitians internationally.**

**How confident are you that you will be able to effectively incorporate, or currently are effectively incorporating, sustainable food systems into your practice?**

*

Choose one of the following answers
Please choose **only one** of the following:

- ◯ Not confident at all
- ◯ Somewhat confident
- ◯ Moderately confident
- ◯ Very confident
- ◯ Extremely confident

**Is there anything else you'd like to tell us about your knowledge, confidence, competence, and dietetic practice regarding sustainable food systems and sustainable diets?**

Please write your answer here:

Thank you for participating in the survey. We look forward to seeing you at the focus group meetings. If you have any inquiries or need to get in touch with the research team, please feel free to contact the principal investigators at poluwafemi@mun.ca or liesel.carlsson@acadiau.ca.

## Appendix IX Three-month Survey

# Sustainable Food Systems- 3-month Survey

Hello and welcome! We would like to express our sincere appreciation for your willingness to participate in this survey. This survey serves as our 3-month follow-up, aimed at assessing any changes in your self-assessed level of confidence and competency in sustainable food systems since completing the learning modules. We understand that your time is valuable, and we estimate that this survey will take approximately 10 minutes to complete. Thank you once again for your valuable time and participation in our research study. If you need to pause and resume later or exit the survey and clear your progress, those options will be available.

There are 8 questions in this survey.

## Demographic

**This section will prompt you to provide your name.**

**Name:** *

Please write your answer here:

*Your name is required in order to link your responses in the survey and focus group. Please be assured that all the information collected during this study will be treated with the utmost confidentiality. To ensure the security of your data, all information will be stored in password-protected Google Drive folders that are accessible only to the research team. Your personal information will be handled in strict accordance with data protection regulations. Your privacy is of paramount importance to us. More detailed information regarding the handling of your personal data can be found in the consent form.*

## Dietetic Practice

**In this next section, we would like to assess your level of knowledge on specific topics as well as your readiness to incorporate this knowledge into practice. Please rate your perceived knowledge on each of the following topics that are related to sustainable food systems using the provided scale. Next, consider the topic as a whole, and indicate how ready you are to incorporate this into practice.**

**How knowledgeable are you about the following topics?**

*

Please choose the appropriate response for each item:

| | I am new to this topic (I want to know more background information about this concept/topic area) | I have a good working knowledge of sustainability concepts/topics (I want to understand the relevance of this topic area to my practice) | I have a good understanding of the concepts/topics and their relevance to my practice (I want to know more about how to implement this topic area into my practice). | I do not know. |
|---|---|---|---|---|
| Food systems; which includes the people, institutions, companies, and infrastructures involved in food. | ○ | ○ | ○ | ○ |
| Social sustainability; which includes culture, economy, equity, gender and sovereignty. | ○ | ○ | ○ | ○ |
| Environmental sustainability; which includes biodiversity, climate change, energy use, land, water and food waste. | ○ | ○ | ○ | ○ |
| Sustainable diets. | ○ | ○ | ○ | ○ |

**Please describe your readiness to incorporate sustainable food systems principles into your dietetic practice.**

*

Please choose **only one** of the following:

- ◯ I am not even thinking about it.
- ◯ I have been thinking about it, but don't know where to start.
- ◯ I have been thinking about it and am actively gathering resources, and planning.
- ◯ I recently started testing out sustainable food system principles in my practice.
- ◯ I actively and regularly apply sustainable food system principles in my practice.
- ◯ I have embedded sustainable food system principles in most or all aspects of my practice.

---

**Please explain your readiness to incorporate sustainable food systems principles into your dietetic practice.**

*

Please write your answer here:

## Confidence

**Sometimes knowledge and readiness to act can be influenced by our confidence in ourselves. We know that confidence in their ability to apply sustainable food systems is a barrier for many dietitians internationally.**

**How confident are you that you will be able to effectively incorporate, or currently are effectively incorporating, sustainable food systems into your practice?**

*

Please choose **only one** of the following:

- ◯ Not confident at all
- ◯ Somewhat confident
- ◯ Moderately confident
- ◯ Very confident
- ◯ Extremely confident

**Please tell us more about your confidence to incorporate sustainable food systems principles into your dietetic practice.** *

Please write your answer here:

## Last Page

**How can the ICDA modules better support your integration of sustainable food systems into practice?**

*

Please write your answer here:

**Is there anything else you'd like to tell us about your knowledge, confidence, competence, and dietetic practice regarding sustainable food systems and sustainable diets?**

Please write your answer here:

Thank you for your participation in this survey and the focus group meetings. We will be sending you your incentives in the next couple of days. If you have any inquiries or need to get in touch with the research team, please feel free to contact the principal investigators at poluwafemi@mun.ca or liesel.carlsson@acadiau.ca

**Appendix X Acadia ethics approval letter**

**Research Ethics Board**

Acadia University Box 181
Wolfville, Nova Scotia
Canada B4P 2R6
Email: smaitzen@acadiau.ca
Telephone: (902) 585-1407
http://reb.acadiau.ca


9 June 2023

Ms. Phebe Oluwafemi
Division of Community Health & Humanities
Memorial University

Re: "Exploring Models and Approaches for Training Sustainable Food Systems in Dietetic Practice: Pilot Study" (REB 23-24, as revised 5 June 2023)

Dear Ms. Oluwafemi,

I am pleased to report that the Acadia University Research Ethics Board (REB) has granted ethics approval to your above-referenced research proposal. In the judgment of Dr. Rebecca Casey, a Representative of Faculty on the REB, the proposed research poses no more than minimal risk of harm to research subjects. Accordingly, your application received delegated ethics review and approval by Dr. Casey and ratification by the entire REB, as provided for in Articles 2.9 and 6.12 of the Tri-Council Policy Statement (TCPS2) on human-subjects research.

This approval is for a term of one year. If your project will not conclude before 9 June 2024, you may contact me at that time for an extension of this term of approval. Please inform me of any significant changes to the research before they are implemented, and notify me by email when your project has concluded.

Best wishes for success in your research.

## Appendix XI Memorial University approval letter

Health Research Ethics Authority
760 Topsail Road
Mount Pearl, NL A1N 3J5
T: 709 864 8871
F: 709 864 8870
www.hrea.ca

May 23, 2023

27a Downing Street
A1B2R9
St. John, Newfoundland

Dear Ms. Oluwafemi:

Researcher Portal File # 20240045
Reference # 2023.061

RE: Exploring Models and Approaches for Training Sustainable Food Systems in Dietetic Practice: Pilot Study

Your application was reviewed by the Co-Chair under the direction of the HREB and the following decision was rendered:

| | |
|---|---|
| X | Approval |
| | Approval subject to changes |
| | Rejection |

Ethics approval is granted for one year effective May 23, 2023. This ethics approval will be reported to the board at the next scheduled HREB meeting.

This is to confirm that the HREB reviewed and approved or acknowledged the following documents (as indicated):

- Consent form dated 19-May-2023, approved
- Emails to professional networks dated 03-May-2023, approved
- Research Advertisement dated 03-May-2023, approved
- Protocol dated 03-May-2023, approved
- Budget dated 06-Apr-2023, acknowledged
- Response email dated 06-Apr-2023, approved
- Focus Group Discussion Guide dated 07-Apr-2023, approved
- Survey Questionnaire dated 07-Apr-2023, approved

Please note the following:

- This ethics approval will lapse on May 23, 2024. It is your responsibility to ensure that the Ethics Renewal form is submitted prior to the renewal date.
- This is your ethics approval only. Organizational approval may also be required. It is your responsibility to seek the necessary organizational approvals.
- Modifications of the study are not permitted without prior approval from the HREB. Request for modification to the study must be outlined on the relevant Event Form available on the Researcher Portal website.
- Though this research has received HREB approval, you are responsible for the ethical conduct of this research.
- If you have any questions please contact info@hrea.ca or 709 864 8871.

The HREB operates according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2), ICH Guidance E6: Good Clinical Practice Guidelines (GCP), the Health Research Ethics Authority Act (HREA Act) and applicable laws and regulations.

We wish you every success with your study.

**Appendix XII Informed consent form**

## Consent to Take Part in Research

**TITLE**: Exploring Models and Approaches for Training Sustainable Food Systems in Dietetic Practice: Pilot Study

**RESEARCHER**: Phebe Oluwafemi Phone Number: 204-583-4214

**SUPERVISOR:** Rachel Prowse Email: rprowse@mun.ca
**:** Liesel Carlsson Email: liesel.carlsson@acadiau.ca

You have been invited to participate in a research project titled 'Exploring Models and Approaches for Training Sustainable Food Systems in Dietetic Practice: Pilot Study'. This form is part of the process of informed consent. It should give you a basic idea of what the research is about and what your participation will involve. It also describes your right to withdraw from the study. In order to decide whether you wish to participate in this research study, you should understand enough about its risks and benefits to be able to make an informed decision. This is the informed consent process. Take time to read this carefully and understand the information given to you. Please contact the researcher, your name here, if you have any questions about the study or would like more information before you consent.

It is entirely up to you to decide whether to take part in this research. If you choose not to take part in this research or if you decide to withdraw from the research once it has started, there will be no negative consequences for you, now or in the future.

### Introduction

My name is Phebe, and I am a Master of Community Health student working under the supervision of Dr. Rachel Prowse of Memorial University and Dr. Liesel Carlsson of Acadia University. As part of my degree program, I am conducting a research study to evaluate the effectiveness of the online International Confederation of Dietetic Associations (ICDA) training modules in promoting sustainable food systems among Nutrition and Dietetic professionals. Specifically, my study aims to investigate how these training modules impact the confidence and competence of dietetics professionals in promoting sustainable food systems in their practice. This research is funded by the Harrison McCain Emerging Scholars Award, Acadia University, and Memorial University.

### What is the study about?

Sustainability is an urgent development priority important to Canadians, and one that dietitians care about a great deal. Environmental degradation and social injustices impact food systems, and subsequently the nutritional well-being of all Canadians, which directly impacts dietitians' work. Similarly, dietitians' clients make choices that impact sustainability on many scales. Research shows that dietitians understand these interactions, however, many feel they 'do not know where to start'. As such, dietitians have identified a need for practical training. This research aims to explore a broad research question: what training models and approaches

effectively support dietetics practitioners' competence and confidence in integrating sustainability into practice? Nutrition and Dietetic Professionals will pilot-test online training modules and provide feedback through focus groups and surveys to evaluate their effectiveness.

**1. Why am I being asked to join this study?**
You are invited to join this study because you are a Nutrition and Dietetic Professional who has demonstrated interest in the topic of sustainable food systems and diets. We hope that you will be able to help us to understand better how to support you and your colleagues to better practice in this area. This study will have 3 focus group sessions about the online ICDA learning modules. The focus group will talk about the learning module's efficiency to help us better understand, from your perspective, in what ways the learning modules would better support dietitians' competence and confidence in contributing to sustainable food systems and diets." There will be a total of 3 focus groups and 3 short survey questionnaires to fill out.

**How many people will take part in this study?**
This study will take place online using the video conferencing platform WebEx with Nutrition and Dietetic Professionals from Canada and Australia. This study will enroll a total of 30 participants, approximately 10 to 15 participants from each region will be chosen.
Potential participants will be screened by the researchers to make sure they meet the inclusion requirements before being chosen as suitable study participants. If there are more than ten volunteers from a particular region, the selection will be based on a first-come, first-served basis, while taking into account the diversity of practice areas. Those who are not selected will be notified via email.

**2. How long will I be in the study?**
In this study, you are asked to spend approximately 12 hours between September to November, with a follow-up survey in February and May 2024. The time you are being asked for will include approximately a 10-minute introduction video, 6 hours of self-led study time (2 hours per month/module), and 5.5 hours in focus group meetings and answering questionnaires.

**3. What will happen if I take part in this study?**
If you agree to take part in this study, the following procedures will take place:

**Workshop:** A 10-minute workshop video will be sent to chosen participants which will introduce them to the research, how to access the learning modules, and participate in the surveys and focus group.

**Focus Groups:** You will have the opportunity to participate in a series of focus group meetings, each comprising 10-15 members. The focus group will consist of a diverse group of individuals, representative of different backgrounds and experiences, who will be asked to share their perspectives on how the learning modules could better support Nutrition and Dietetic Professionals' competence and confidence in sustainable food systems. Each online meeting through WebEx will last approximately 90 minutes and will be held after the completion of each learning module. There will be three focus group meetings in total, scheduled for September 2023, October 2023, and November 2023, respectively.

The researchers, Liesel Carlsson and Phebe Oluwafemi will moderate and organize the focus group meetings. Each focus group meeting will be recorded and transcribed by the researcher.

**Survey:** You will be asked to fill out three 15-minute survey questionnaires. The surveys will be administered online using the survey platform LimeSurvey. The first one will be filled out before the first focus group meeting. The second one will be filled out 3 months after completing the modules in February 2024 and the last one will be filled out in May 2024. This will be the end of your contribution to the research.

**Learning modules:** The purpose of the three learning modules is to provide you with a comprehensive understanding of sustainable food systems, and how they relate to your practice. Each module includes texts, videos, reflection exercises, and additional resources related to the topic. The three learning modules are titled as follows:

1. What are Sustainable Food Systems and Diets? This module will introduce you to the foundational concepts of sustainability and food systems.
2. How are Sustainable Food Systems and Diets Relevant to Nutrition and Dietetic Practice? In this module, you will learn about the relationship between food systems, sustainability, and your practice. You will also explore the link between dietary patterns, sustainable food systems, and health.
3. How to Contribute to Sustainable Food Systems and Diets in Your Practice: This module will teach you how to contribute to sustainable food systems and diets in your practice.

**4. Are there risks to taking part in this study?**

There is a minimum risk involved in participating in this study. There is no physical, emotional, or social risk associated with this study.

**Sharing personal information:**

Participants may experience some level of discomfort when sharing their opinions and views in a group setting. However, they will have the option to withdraw from the study at any time. It is important to note that participating in this study does require a time commitment.
The participant may feel uncomfortable providing their name on the survey, however, it is needed to link participant's responses over time to measure the change in confidence and competence in the topic.

**Focus Groups:**

Although the researchers will take every precaution to maintain the confidentiality of the data, the nature of virtual focus groups prevents the researchers from guaranteeing confidentiality. You will all be in the same virtual meeting room with cameras on and using names. The nature of the information you are discussing does not require you to share personal information; however, you may want to think carefully about how you choose to share identifiers in your context, such as the names of colleagues or employers who are not part of the study. There is a risk that what you say will be heard and/or repeated by other participants, and that this may imply harm to your professional reputation. The researchers ask that all participants respect the privacy of their fellow participants and treat all information shared with the group as confidential.

**Confidentiality risk:**
Despite protections being in place, there is a risk of unintentional release of information. Researchers will make every attempt to protect your privacy.
All focus group meetings will be audio and video recorded.

- **Audio recording used**: You will be audio-recorded during the 3 focus group sessions. The audio recording will be transcribed (written down) after the focus group and will be analyzed by the research team. The transcription will be done by members of the study team. The audio recording will be destroyed after it has been transcribed and checked for accuracy.
- **Video recording used:** Participants are advised to keep their cameras on to facilitate a better discussion.
- The data gathered will be securely stored and will be maintained by the researcher team members.

**The inconvenience of time:**
There is a time commitment required to participate in this study. You will need to dedicate approximately 12 hours between September 2023 and May 2024 to complete the study. Every participant will receive a $30.00 gift card, regardless of which study activities they complete. However, if you stay involved in the research until the 3-month survey, you will get an additional $70.00. All participants will receive their gift card incentive after the 3-month survey.

**What are the possible benefits of participating in this study?**
Nutrition and Dietetic Professionals are increasingly being asked to participate in, and even lead, work related to sustainable food systems. We hope that the insights gained from this study will benefit your work and that of other Nutrition and Dietetic Professionals in the future. In certain countries, Nutrition and Dietetic Professionals are expected to engage in continuous competency development and reflective learning. This study may fulfill those requirements, and we encourage you to reach out to your college to clarify.

**5. If I decide to take part in this study, can I stop later?**
It is your choice to take part in this study, participation is voluntary. You can change your mind at any time during the research study. The study team may ask why you are withdrawing for reporting purposes, but you do not need to give a reason to withdraw from the study if you do not want to. Withdrawal from the study will not have any effect on you. If you withdraw from this study, the study team will not destroy the study data that has been collected. All the information collected from the focus group responses and survey questionnaire will be kept by the research team.

**6. What are my rights when participating in a research study?**
You have the right to receive all information that could help you decide about participating in this study, promptly. You also have the right to ask questions about this study at any time and to have them answered to your satisfaction.

Your privacy rights are legally protected by Canadian federal and provincial laws that require safeguards to ensure that your privacy is respected.

Signing this form gives us your consent to be in this study. It tells us that you understand the information about the research study, the expectation of participating, and agree to participate. When you sign this form, you do not give up any of your legal rights.

You have the right to be informed of the results of this study once the entire study is complete. Participants will be emailed a link to the study results after the study has been completed and analyzed.

You will be given a pdf copy of this consent form, and you must sign and return the consent form to the researcher. You may sign the document electronically or by printing your name.

**7. What about my privacy?**

The researchers will collect and use the following information:

- Name
- Email
- Information from the focus group
- Information from the survey questionnaire
- Video and audio recordings

Study information collected during the study will be kept in password-protected Google Drive folders accessible only to the research team. After the study closes, data will be kept for a minimum of five years, as required by Memorial University's policy on Integrity in Scholarly Research.*"*. Phebe Oluwafemi and Liesel Carlsson are the persons responsible for keeping it secure.

When the results of this study are published or presented at scientific meetings, your name and other personal information will not be used. Any data shared will be done so thematically, or in the aggregate, meaning that no individual data or responses will be shared.

All information that identifies you will be kept confidential, and to the extent permitted by applicable laws, will not be disclosed or made publicly available, except as described in this consent document. Every effort to protect your privacy will be made. Even though the risk of identifying you from the study data is very small, it can never be completely eliminated. If there is a breach of your privacy resulting from your participation in this study, you will be notified. Participants will be notified of any breaches until your data is destroyed after 5 years.

This study will be conducted using the online Web-Ex video conferencing platform and will communicate with participants through email. Participants will be communicated to using email. Please note that communication via e-mail is not absolutely secure. We do not recommend communicating sensitive personal information via e-mail. Please note that in many jurisdictions, employers are legally entitled to access their employee's email accounts. If you do not want that to happen, we suggest you participate using a separate personal email.

**8. Who will see my personal information?**

There will be no disclosure of personal identifiers outside of the research team members. Representatives from the Health Research Ethics Board may come to look at the study records and your personal information under the supervision of the study staff to check that the information collected for the study is correct and to make sure the study followed the required laws and guidelines.

**Your access to records**

You have the right to see the information that has been collected about you for this study. If you wish to do so, please contact the investigator.

**9. Reporting of results**:

Upon completion, my master's thesis will be available at Memorial University's Queen Elizabeth II library and can be accessed online at: http://collections.mun.ca/cdm/search/collection/theses.

Participants will be emailed a link to the study results after the study has been completed and analyzed.

The research result will be presented at the International Congress of Dietetics 2024 conference. The result of the research will also be shared on the International Confederation of Dietetic Associations website icdasustainability.org.

**10. Declaration of conflict of interest**

There are no conflicts of interest to declare related to this study.

**11. Research funding**

This project is funded by the Harrison McCain Emerging Scholars Award.

**12. Questions or problems?**

If you have any questions about taking part in this study, you can meet with the principal investigator who is in charge of the study. That person is:

[*Liesel Carlsson* at liesel.carlsson@acadiau.ca]

[Or you can speak to the other research team members: Phebe Oluwafemi: at poluwafemi@mun.ca]

Or you can talk to someone who is not involved with the study at all but can advise you on your rights as a participant in a research study. This person can be reached through:

Ethics Office at 709-777-6974
Email at info@hrea.ca

**Signature Page**

Your printed name on this consent form means:

- I have had enough time to think about the information provided and ask for advice if needed.
- All of my questions have been answered and I understand the information within this

consent form.

- I am aware that by consenting, participants have not waived any rights to legal recourse in the event of research-related harm.
- I understand that my participation in this study is voluntary.
- I understand that the researchers will be recording the focus group meetings.
- I understand that I am completely free at any time to refuse to participate or to withdraw from this study at any time, without having to give a reason.
- I understand that it is my choice to be in the study and there is no guarantee that this study will provide any benefits to me.
- I am aware of the risks of participating in this study.
- I do not give up any of my legal rights by signing this consent form.
- I understand that all of the information collected will be kept confidential and that the results will only be used for the purposes described in this consent form.

_____

Participant name Day Month Year

_____

The name of the person conducting the consent discussion Day Month Year

_____

**To be signed by the Researcher:**

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participants fully understand what is involved in being in the study, any potential risks of the study, and that they have freely chosen to be in the study.

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The name of Principal Investigator Day Month Year