

# Application of hybrid learning interventions in advancing food and nutrition pedagogy in UAE and beyond through Culinary Science to sustain human health and wellbeing

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## Abstract

*Suboptimal nutrition remains a crucial threat to public health globally, and most importantly in UAE. During the last decade, UAE has experienced a significant decrease in home-based food preparation and a paradigm shift towards ultra-processed foods. Consequently, the impacts of undernutrition, malnutrition, and overnutrition have been evidenced by a surge in nutrition-based diseases such as obesity, diabetes mellitus, and cardiovascular diseases. Such contexts have generated a growing interest in nutrition pedagogy as an approach to promote science-based culinary interventions to improve food choice, cooking, and eating habits. Proponents of food and nutrition pedagogy emphasise the need to espouse a pedagogical model and approach that incorporates Arab and westernised ingredients plausible. Vernacular recipes have blossomed into a project that is both pedagogical and research-driven around the UAE contextualised culture. Incorporating westernised recipes would make the nutrition pedagogy adaptable to modern westernisation. Although researchers have always argued for or against classroom and online learning as independent entities, this research hypothesises that hybrid learning, where classroom and virtual learning overlap one another (Dubec, 2017), is the new and innovative approach to Culinary Science in engaging students and to promote culinary skills for more excellent human health and wellbeing in UAE. This research aimed to determine the significance of a hybrid learning intervention in promoting food and nutrition pedagogy in the UAE and establish special requirements and conditions for the successful application of hybrid learning in the pedagogy. Ecological System Theory and Fourth Generation Activity Theory (4GAT) were used to guide this study. Questionnaires were distributed to n = 60 Home Economics teachers, out of which n = 24 responses were received. Inferential analysis of the responses received has shed light on factors that affect the application of hybrid learning in advancing food and nutrition pedagogy, as determined by this study. Various factors influenced the fluidity, pedagogy, and social support aspects of food and nutrition, especially in the presence of COVID-19 pandemic.*

**KEYWORDS:** HYBRID LEARNING, CULINARY SCIENCE, PEDAGOGY, CULINARY SKILLS, VERNACULAR RECIPE, COVID-19

## Introduction

### Background of the study

Like many other countries globally, the United Arab Emirates (UAE) faces challenges with nutrition education at the secondary school level where the need Home Economics can be pivotal to educate the nation. The country has also registered considerable population growth in recent years, which has been corresponding with its economic growth. The growth has generated a change in lifestyle

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and consumption patterns, which has seen a drastic reduction in home-based food preparation and a paradigm shift towards processed foods. Thus, as much as the country still suffers from undernutrition and malnutrition, it is overnutrition that has affected the country the most. An increasing number of UAE citizens are consuming more foods than their bodies need. Junk foods have become a common feature in the country as more people switch from healthy eating to eating processed foods in the past years. The food and nutrition problems experienced in UAE and beyond generates an opportunity for Home Economics teachers to explore new ways to access homes with the importance of Home Economics learning via new technological platforms. The shift also generates the need to focus on the development of culinary skills, especially among young people. This study hypothesises that hybrid learning is a better approach to be used in public and private schools in dispensing knowledge on food and nutrition.

### **The need for Culinary Science and Nutrition Education in UAE**

The evidence of over-nutrition in the UAE can be seen in the increase in nutrition-based diseases such as obesity, diabetes mellitus, and cardiovascular diseases. According to Global Nutrition Report (2020), “The United Arab Emirates is ‘off-course’ to meet all of the global nutrition targets for which there was sufficient data to assess progress” (Para 1). The report establishes that while the prevalence of obesity in the Middle East and North Africa (MENA) averages at 8.7% for women and 6.0% for men, the prevalence of obesity in UAE is 41% for adult women and 27.5% for adult men, which is exceedingly high (Global Nutrition Report, 2020). The case of obesity in the UAE is a sufficient example to showcase that the country has indeed made little progress towards dealing with diet-related non-communicable diseases (NCDs).

As such, there is a need to create mass awareness on nutrition to promote science-based culinary interventions. Such an initiative will help people make appropriate food choices, prepare home-based foods, and develop healthy eating habits (Schuster, 2012). Eating habits in the UAE has changed over the last years, that the country has been undergoing an economic transformation (Eslick & Abdeljaber, 2020). The country’s population has largely become either middle-class or wealthy. Consequently, many people find it easy to buy ready-made food instead of cooking for themselves in their homes. Additionally, the nanny culture is growing in UAE. Many Emiratis and expat families hire maids or nannies to take care of home chores, including cooking and caring for children (Sanderson, 2019). In most cases, they are less skilled in the appropriate choice of foods and cookery, which expose children to greater health risks.

As a remedy, there are ongoing discussions on proposing a new food and nutrition pedagogy that incorporates the Arab and westernised ingredients. Home Economics should be integrated into public schooling to educate students on how to be holistic consumers (Aburime & Uhomoihi, 2010). There are local recipes that can be combined with the westernised recipes to produce modern foods that are both tasty and healthy. Incorporating Culinary Science and Nutrition Education into the UAE school syllabus is a pragmatic approach to ensure a long-lasting change in the population’s eating habits.

Culinary Science and Nutrition Education (CSNE) is a field of study that concentrates on the functions of ingredients in various foods and food products not only to improve the taste but, most importantly, to escalate food safety and health benefits. CSNE pedagogy is designed to reinforce and enhance knowledge on scientific principles and processes of handling and preparing food. It instils knowledge on food quality and safety, food processes and engineering, food chemistry analysis, and general culinary skills.

Establishing the appropriate food ingredients to utilise in preparing foods, macronutrients and energy balances, viscosity, colour, pH, moisture content, texture, flavour, taste, and food appearance, which are skills attainable through CSNE, is critical in ensuring that prepared foods are not only safe but generally acceptable to consumers (Nolen, 2017). Thus, propagating food preparation skills through CSNE, which is a branch of Home Economics is critical in promoting understanding of the science behind foods and beverages in an effort to enable culinary experiences that are safe, creative, delicious, and consistent, especially in UAE, where nutrition-based non-communicable diseases continue to be major threats.

### **Pedagogical techniques used in UAE**

Implementation of CSNE, or Home Economics in general, in UAE calls for an appropriate examination of the pedagogical technological instruments or platforms used to dispense educational contexts, knowledge, and skills in the country. According to Yu et al. (2017), safety, engagement, and connectedness are critical elements of a school's environment for students to learn. These factors are critical contributors to learners' achievements and are linked with higher grades and scores. A study by Berkowitz et al. (2016) revealed that in addition to having skilled and excellent teachers to teach subjects, having a positive school environment that is characterised by strong attendance, positive relationship between students, extensive engagements of parents and peers, and minimal engagement in risky behaviours could escalate learning achievements and narrow achievement gaps.

Until the outbreak of the COVID-19 pandemic, UAE has been primarily dependent on face-to-face learning that demands that learners and teachers be in the same location at a specific time to promote curriculum dispensation. The onset of the pandemic generated extraordinary circumstances that for students, teachers, parents, schools, and government regulators, igniting the need for an alternative to face-to-face learning (Eslick & Abdeljaber, 2020). In early 2020, schools in UAE made a mandatory shift to online learning to continue the 2019/2020 academic year (Eslick & Abdeljaber, 2020). Since then, the Ministry of Education (MoE), in collaboration with the private sector, has made efforts to establish stringent protocols that would allow students to return to physical classrooms, albeit the pandemic. On August 16, 2020, the UAE's MoE made an announcement that distance learning would be available and optional to all. The ministry proclaimed;

Parents have been allowed to freely choose between their children's mode of attendance, face to face at school or through distance learning, for the first term, to achieve stability within the school community and to ensure the safety of our students, while meeting the requirements of physical distancing (Mansoor, 2020, Para 4).

The proclamation by UAE's MoE, as supported by other studies, indicates that distance learning technology cannot fully replace face-to-face learning despite its widespread adoption. In the words of Cochrane et al. (2020), the coronavirus pandemic has intensified the awareness of digital tools and their role in education, but the next world should not be the one where schooling is purely defined by distance learning. Researchers agree that online teaching cannot provide some of the benefits of face-to-face learning, taking into consideration the low level of active interaction associated with it (Cochrane et al., 2020; Leslie, 2014). The contentions between face-to-face learning and distance learning have led to the development of hybrid learning.

### **Hybrid learning**

Hybrid learning has emerged as one of the leading methods of delivering education to modern-day students. This method of learning combines the benefits of face-to-face instruction and technology-based learning (Tamim, 2013). Hybrid learning is an educational model where the instructor delivers live instructions both in the classroom and remotely at the same time (Kabongo, 2020). Generally referred to as synchronous instruction, this model of instruction dispensation also utilises asynchronous online learning elements such as pre-recorded instruction videos and online exercises that support face-to-face classroom sessions (Zhou & Yao, 2017).

The goal of hybrid learning is to enrich the learning processes by blending face-to-face learning and online learning to stimulate their benefits and overcome their weaknesses (Yamazumi, 2008). The adoption of hybrid learning is attached to numerous benefits; increased flexibility of learning experience, more synchronous communication opportunities, increased freedom of independent academic exploration, and more efficient use of financial and academic resources to foster learning objectives (Parkes et al., 2011). More flexible learning schedules, teaching modes, student engagements with learning materials, collaboration and communication among peers and with instructors are more attainable if learners are granted the opportunity to choose between in-person class attendance and remote class attendance while attaining the same quality of instructions (Aburime & Uhomibhi, 2010; Yamazumi, 2008). With hybrid learning, students can learn from the location of their choice, develop deeper asynchronous discourse with their peers, and revisit materials whenever they wish to.

### A history of hybrid learning and its application in food and nutrition pedagogy

Although virtual or blended learning, as it is known today, has blossomed with the invention of computers and the worldwide web, its foundation dates back to the early 19th century when the term *distance education* surfaced (Tandoh et al., 2014). In the 1840s, Sir Isaac Pitman introduced distanced learning by sending shorthand texts and assignments to his students via mailed postcards (Kabongo, 2020). He could then require the students to send the assignments back via mailed postcards for grading and correction (Tandoh et al., 2014). Even though computers and mobile devices had not been conceptualised during this time, Pitman's distance learning turned to be a success.

The concept of distance learning would proliferate with the invention of mainframe computers in the 1960s and 1970s (Pappas, 2015). Although the mainframes were rarely used in schools, organisations used them to train their employees without face-to-face indulgence. Notable systems such as Plato were used as platforms to facilitate the training process. Employees could simply log in to the system and access training information. In the 1970s and 1980s, TV-based technology was used to support live training through video networks (Pappas, 2015). Learners were able to physically interact with their peers while watching their instructor on TV. Their questions and concerns could then be addressed by mail. The use of CD-ROMS to deliver more interactive learning experiences through learning management systems (LMS) became popular in the 1980s and 1990s (Pappas, 2015).

The innovation of web-based instruction in 1998 instigated a rapid change towards online learning (Tandoh et al., 2014). People and households began purchasing personal computers on a large scale. The use of graphics, videos, and sounds became more immersive with the invention of browsers increasing connection speed and offering greater interactivity (Parkes et al., 2011). Although efforts during the early 2000s were on developing a general paradigm shift towards e-learning, gradual improvements and changes have showcased the need to blend face-to-face instruction and technology-driven learning both synchronously and asynchronously to improve learning outcomes (Hrastinski, 2008; Leslie, 2014; Nazarenko, 2014). With the hybrid system, instructors can interact with their students both physically and remotely, share instruction materials remotely, perform laboratory experiments through video demonstrations, and can organise online and physical assessments (Astudillo et al., 2020).

Various elements form part of the synchronous and asynchronous aspects of hybrid learning. Table 1 below lists some of the elements of the synchronous and asynchronous aspects of hybrid learning. Tsiflikiotis et al. (2017) note that the elements of hybrid learning are just mere tools that cannot contribute to successful learning outcomes without proper consideration of social and environmental factors. He exclaims further that in addition to the hybrid learning elements, factors such as a comprehensive learning management system, well-defined syllabuses, clear learning objectives, good communication, and consistent aesthetics are absolutely necessary.

Table 1 Synchronous and asynchronous elements of hybrid learning

Elements of Hybrid Learning	
Synchronous	Asynchronous
Face-to-face/Online Meetings	Study of materials
Webinars	Working with technical guidelines
Discussions	Complimenting lessons/Tests
Consultations	Working in groups/subgroups
Tests & Quizzes	Preparation of Reports

Thus, it is proper to say that teaching Home Economics, or CSNE, to be specific, requires extensive consideration of various pedagogical factors and how they can be improved through hybrid learning interventions (Schuster, 2012). The rapid change in technology affects how people learn in schools and foresee the need for extension educators on nutrition programs to stay abreast of technological trends and how the changes impact their pedagogical deliveries (Hadijah and Shalawati, 2019). As Muglietti (2009) emphasise, ICT integration in Home Economics increases teachers' confidence in sharing ideas and providing feedback concerning learning outcomes. The researcher also argued that

as teachers continue to interact in an asynchronous learning environment, what matters most is the “how-to” knowledge when diffusing innovation into practice. These hybrid elements are summarised in Figure 1.

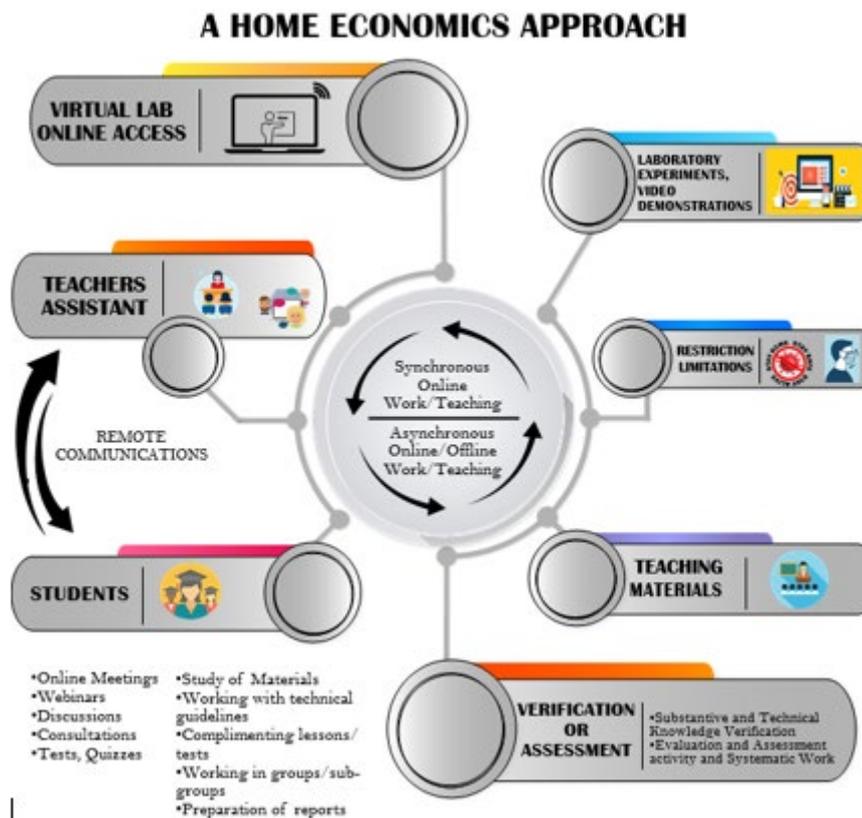


Figure 1 A Home Economics approach during COVID-19

As touch screen and videoconferencing technologies become ubiquitous, their application in fostering food and nutrition education through virtual learning, mobile learning, and the visual web becomes absolutely necessary. Pendergast et al. (2012) in *Creating Home Economics Futures* emphasise that there is no doubt the internet is changing the way people work, live, and play and that the digital age provides the opportunity to reconsider the impacts and influence of Home Economics on modern societies through developments in communication technologies. Education systems need to utilise multimodal means (physical and virtual meetings, texts, visual images, audios, and videos) to advance food and nutrition pedagogy to promote sustainable human health and wellbeing (Pendergast et al., 2012). Figure 1 showcases a model on how hybrid learning elements could be developed into a Home Economics approach.

### Statement of the problem

Proper food and diet is a primary determinant of sustainable health and wellness. However, attaining proper diets and healthy foods is increasingly becoming a challenge, especially in a world where fast foods and processed foods have become the new normal. The consequences of the paradigm shift from homemade food to processed and fast foods are evident. Cases of nutrition-based non-communicable diseases are increasing at an alarming rate. UAE is specific has one of the highest rates of these diseases in the MENA region. It is important that the MoE put forth the need to develop a Home Economics curriculum that enables CSNE in UAE public and private schools as a mandatory subject. UK is way ahead with this as Cookery and Nutrition are compulsory in all UK schools since 2014 (Rutland & Turner, 2020). Conventionally, the country has been dependent on face-to-face interventions. The outbreak of COVID-19 has seen it make a drastic paradigm shift to distance learning. This study presupposes that going forward, the country will need to adopt comprehensive hybrid learning systems, especially in advancing food and nutrition education. The study tests this presumption and determines approaches for hybrid learning integration. It is, however, important

that the country understands the importance to prepare a workforce to overcome such barriers and to implement an infrastructure where UAE citizens are prepared to teach Home Economics to future children within the Emirati as they the most precious wealth in the country on Health and Wellbeing through the use of practical lessons. However, this could only be achieved with the right technological advances making them available to teachers.

### **Purpose of the study**

This research determines the significance of a hybrid learning intervention in promoting food and nutrition pedagogy in the UAE and establishes special requirements and conditions for the successful application of hybrid learning in the pedagogy. Further, this study focuses on hybrid learning interventions in promoting food and nutrition education in the UAE. Introducing Home Economics in the country's syllabus can help cultivate human health and individual wellbeing. The UAE has been experiencing suboptimal nutrition over the past years. The challenges of nutrition remain a significant threat to public health in the country that can best be addressed through appropriate approaches to pedagogical interventions. Home Economics, of which food and nutrition is part, is a practical subject that weaves together approaches that integrate scientific knowledge from the different school subjects to help students gain a broader perspective, thereby helping develop integrative thinkers with interdisciplinary skills needed in today's world.

### **Research questions**

- Is hybrid learning intervention significant in promoting food and nutrition pedagogy in UAE?
- What special requirements are necessary for the successful application of hybrid learning in the food and nutrition pedagogy?
- What conditions are necessary for the successful application of hybrid learning in the food and nutrition pedagogy?

## **Literature review**

### **Theoretical review**

#### *Ecological System Theory*

The ecological system theory advanced by Bronfenbrenner (1977) as cited in Soyer (2019) holds that the environment of an individual child is a nested arrangement of structures in which one is contained within the next. These structures include microsystem, mesosystem, exosystem, macrosystem, and chronosystem (Soyer, 2019). They are interrelated in such a way that the influence of one structure on an individual child's development is hinged on its relation with the other structures.

The microsystem forms the first and innermost structure. It involves things that have direct contact with the child within their immediate environment. These may include school peers, parents, teachers, siblings, religious organisations, and health services. The relationship that exists between an individual child and their environment within this structure is bio-directional in which they can be influenced by other people within the environment, and they can also influence others within the same environment (Tudge et al., 2016). Similarly, a child's reaction to individuals within the same environment can influence how they are treated in return. Through all these, the interactions within this specific structure are always personal and are essential in fostering and supporting an individual child's development. At this level, an individual's food choices may be influenced through mechanisms such as role modelling, social support, and social norms.

The mesosystem forms the second structure and involves the interaction between the different elements within a child's microsystem. Such can include the interaction between an individual's peers and siblings as well as between parents and teachers. For instance, if a teacher communicates to a child's parent, the interaction will definitely influence a child's development like their ability to examine their own values with respect to the food system as well as the adeptness of an individual learner to comprehend multiple values and perspectives that exists within the food system, which may include diverse cuisines (Soyer, 2019). On the same note, the theory asserts that a child's positive development highly depends on good relations among the different elements within their microsystem, while a soaring relation of these elements negatively impacts a child's development.

The exosystem forms the third structure and involves other formal and informal social structures, which do not themselves contain the child but indirectly influence an individual child as they affect one of the microsystems. Examples of these include the mass media, the parent's workplace, and the parent's friends. Such form an environment outside the child's experience and that does not involve them directly but still affect their development (Tudge et al., 2016). It influences the proficiency of an individual learner to generate an astute understanding of the larger socio-political context and other factors like the diversity that shapes the food system as well as shape their comprehension of multiple values and perspectives that exists within the food system, which may include diverse cuisines.

Likewise, the macrosystem forms the fourth and second last structure and include elements like food marketing, social norms, food production and distribution systems, agriculture policies, and economic price structures (Soyer, 2019). An element like social norm may include ethnicity, wealth, and socio-economic status. For instance, the specific culture with an individual child's environment may influence an individual child's beliefs and perception regarding the food and nutrition system within their environment. Compared to the first three structures, it does not major on the specific environment of one child but rather the existing society and culture through which the child is interacting with.

Lastly, the chronosystem forms the fifth and last structure and involves the environmental changes that a child may encounter within their lives and may influence their development. Such can include major life transitions and historical events like the recently witnessed COVID-19 pandemic that devastated almost all sectors across the globe. Other examples may include a child starting school or parents moving to a new house, or getting divorced. Such may influence a) the adeptness of an individual to comprehend multiple values and perspectives that exists within the food system, which may include diverse cuisines; b) the proficiency of an individual to generate astute understanding of the larger socio-political context and other factors like the diversity that shape food system; and c) the capacity for individuals to enhance their commitment towards generating a sustainable food system in a just manner. The following diagram summarises the ecological system theory.

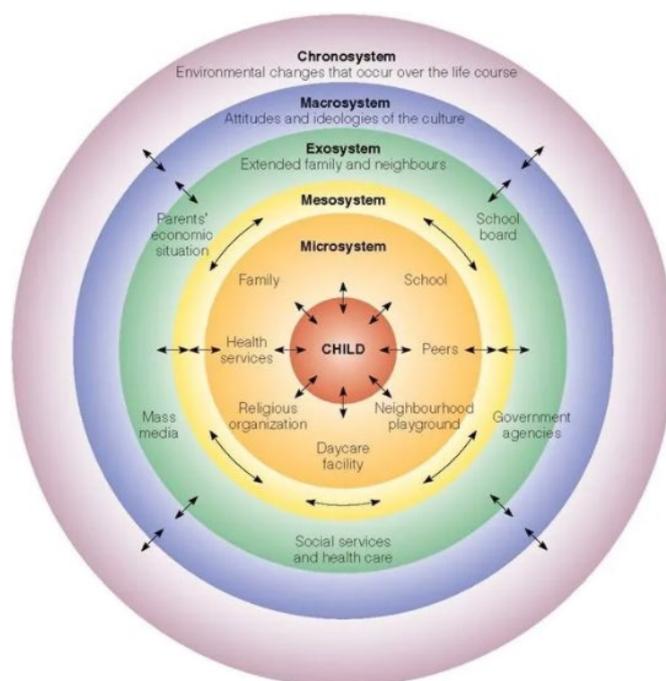


Figure 2 Bronfenbrenner's Ecological Systems Theory Adapted from Guy-Evans (2020)

#### Fourth Generation Activity Theory-4GAT

Activity theory provides an interdisciplinary approach that is highly effective in understanding the learning process from all social and human sciences, including economics, sociology, psychology, philosophy, engineering, and medicine (Spinuzzi & Guile, 2019). By incorporating all these branches of human and social sciences, activity theory helps in answering four essential questions: a) who are

the subjects involved and how are they defined and located; b) why do they learn and what drives them to make an effort; c) what do they learn, including the content and expected learning outcomes; d) how do they learn including the essential actions and the learning process.

The theory has been in place for a considerable period of time and has evolved over the ages into four generations. At the core of the fourth-generation activity theory (4GAT) is the exploration of the complexity of structures and organisations that have bloomed through digital media. As advanced by Engeström (2001), it is in place to handle “mycorrhizae activities.” Such activities include structures that may be impossible or difficult to bound and close, while in the real sense, they are not elusive or indefinite. Examples of such activities may include the spread of religious extremism in regards to food consumption. Both create patterns of objects and subjects that resist the explicit organisation observed in the meditational triangles in third-generation activity theory.

The 4GAT is advanced with a view to solving two sets of problems in the community. These include peer and social production as well as the networked organisation of labour and production. Regarding the peer and social production strand, the 4GAT contextualises it as a collaboration of individuals across or outside organisations and which the boundaries and structures of activity systems seem to gradually lose their value (Wiser et al., 2019). Through this, it seeks to address problems such as hacking in education and the viable ethical grounds such can be considered an offence as well as what form of relationship among the actors can be applied to avoid such. As a result, 4GAT seeks to address runaway objects that can be effectively managed by a single stakeholder.

On the other hand, while solving the problems due to the networked organisation of labour and production in food and nutrition systems, 4GAT highlights the essence of the information system in solving problems. As a result, it aims at reframing the notion of objects to account for more expansive objects, as in the case of information science, towards enhancing the effectiveness of CSNE in society. Apart from these two sets of problems, there are several other problems that 4GAT seeks to address, and they include social capital and its influence on Home Economics. Some other problems include motivation, emotion, and identity of individual learners within the field of CSNE (Wiser et al., 2019). All these are applicable within the learning environment, especially those that involve the integration of different teaching and learning techniques, as in the case of blended learning. The application of different elements of 4GAT within the hybrid learning system always ensures effectiveness and efficiency as it offers a structured approach of identifying any form of obstacles that may arise within the CSNE together with the conventional techniques that can be applied to eliminate such.

The two theories project numerous factors that might impact a child’s learning processes and outcomes. From the ecological system theory, family and school are the most important microsystems that impact the learning process. At the exosystem level, government agencies and school boards have a greater fundamental role compared to others in ensuring that learning processes are streamlined to meet national and international standards. In addition to these, it is admissible that there are various cultural ideologies and attitudes as well as environmental changes that influence a child’s learning processes (Tudge et al., 2016). It is therefore important to assess and question each of these factors to determine how their specific elements impact learning outcomes, specifically with Home Economics in mind. 4GAT condenses and simplifies the factors formulated in ecological system theory into four fundamental questions aimed at understanding the subjects and their locations, what motivates them to learn, what they learn, and how they learn (Wiser et al., 2019). In this sense, it can be transposed that factors that influence learning processes can be categorised into three classes; fluidity, pedagogy, and social and emotional support. Fluidity generally concerns external factors that impede or streamline the learning processes. For instance, the outbreak of COVID-19 has greatly hindered face-to-face interactive instruction and made online-based learning and hybrid learning absolutely necessary. Fluidity is subject to various factors, such as the adoption of the right technology, incorporation of digital tools and resources, leadership, and professional development (Jaspers & Madsen, 2019). Pedagogy incorporates numerous factors that are directly involved in teacher-student interaction. Such factors might consist of teachers’ competency, proper organisation of instruction materials and resources, student’s preparedness to learn, balancing teaching techniques and methods, and customisation of learning activities and match specific learners’ needs, amongst others (Newby, 2018). Social and emotional support incorporates collaboration between learners and students and the active involvement of parents amongst others. This study attempts to test and rank these factors amongst others to determine their relevance in promoting the adoption of hybrid learning to advance food and nutrition pedagogy in UAE.

## Empirical review

### *Impacts of hybrid learning interventions on food and nutrition pedagogy*

As identified by Butz and Stupnisky (2017), the nature and scope of hybrid learning are quite extensive, especially in higher education and corporate setting. The study also identified that the existing diversity among individuals and communities and the different manners in which they apply blended learning present a significant challenge in generating a comprehensive definition of the same. However, the study identified three common grounds from which hybrid learning can be explained. These include a) the use of traditional learning approaches together with web-based online approaches; b) the combination of both media and tools like textbooks integrated into an e-learning environment and c) the integration of different learning approaches irrespective of the technology used.

On the same note, Woodhouse et al. (2015) also tried to solve the ambiguity surrounding the definition of hybrid learning by projecting it as a mixture of instructional modalities, delivery media, instructional methods, and web-based technologies in ensuring effective learning environment. The instructional modalities identified by the study include self-paced learning, web-based learning, and onsite learning, while the delivery media advanced on the same include classroom sessions, internet, web-based courses, PowerPoint slides, books, videos. Likewise, instructional methods advanced by the study include technology-based sessions and face-to-face sessions. Similarly, web-based technologies may include both synchronised and asynchronised elements like online courses, virtual classrooms, chat rooms, and blogs (Rocamora et al., 2019). Further, the study also identified some specific factors that influence the choice of blend that is used. Some of the factors include the nature of the course content and learning outcome goals, the characteristic of individual students and their learning preference, the applicable teaching style, and the teacher's experience as well as online resources.

Butz and Stupnisky (2017) identified that hybrid learning is highly sensitive to the different learning strategies hence can be tailored to meet the specific needs and preferences that exist among individual students and instructors in ensuring a highly effective learning process that creates value to all stakeholders. The study also identified that hybrid learning encourages collaborative learning in which both the students and their instructors can work on some projects remotely from their comfort zones. Such a mode of learning requires the use of relatively advanced technology by both the educator and the students. Likewise, the study also identified that blended learning is also essential in promoting intercultural awareness by both educators and students. This forms an integral part of the learning process in a globalised contemporary world where individuals from diverse cultures and with different backgrounds freely interact in a productive manner. The study further advanced that blended learning is cost-effective since both educators and students do not need to do the actual travelling to educational settings or schools to affect the learning process. However, López Núñez et al. (2020) objected to the cost-effectiveness of blended learning, considering that in most cases, it involves the integration of different technologies innovatively. The acquisition and maintenance of the necessary technologies involved are always costly and may not be sustainable in some cases.

Flowers and Swan (2015) performed a study to establish the efficiency and effectiveness of hybrid learning in New Zealand secondary schools. Among the findings established generated from the study include extended flexible interaction between the educator and the students during the learning process, increased confidence and improvement in ICT skills among the stakeholders, development of independent learning skills, and the development of self-management and higher-order thinking skills among students. All these were quite similar to the specific impacts of blended learning advanced by Woodhouse et al. (2015). Some additional impacts of hybrid learning advanced by the study include the professional growth of individual teachers and the improvement of school infrastructure to suit the necessary infrastructural development in the contemporary world.

In a study done to explore the impact of blended learning within the healthcare profession, Liu et al. (2016), observed that hybrid learning provides an effective alternative approach in the education sector. This arises from its utility in synthesising the viable attributes in both the e-learning framework and traditional learning framework. As a result, the use of blended learning has witnessed a considerable growth rate in the contemporary world. Some of the impacts of hybrid learning highlighted by the study are its ability to transcend space and time boundaries and improve the level

of convenience derived from this sort of learning. The study also identified that hybrid learning promotes collaborative and individualised learning. Additionally, through the use of interactive media multimedia, it provides up-to-date information that can also be re-used (Leahy et al., 2015). However, it also identified that blended learning results in negative impacts like learners feeling of isolation in a virtual environment and costs emanating from continuous costs of platform maintenance and high costs involved in maintaining multimedia materials.

Through all these, there are several studies that have been conducted in light of the significance of hybrid learning, especially in the highly volatile contemporary world's environment. Its sensitivity to different learning approaches and teaching techniques and mechanisms is essential in ensuring a highly effective learning process in a manner that creates value to all stakeholders. Hybrid learning also encourages a collaborative learning process in which both the learners and the educators cooperate closely to ensure a high-quality learning process regardless of their physical distance between them. Similarly, it also promotes intercultural awareness, which is crucial in the highly globalised contemporary world. Some additional impacts of blended learning include professional growth among individual teachers, provides an avenue to improve the existing school infrastructure to suit the demands and needs of the learning environment in the 21st century, and the development of independent learning skills. Though such impacts of hybrid learning have been observed by several studies, there are just handful of studies that have advanced the impacts of hybrid learning interventions on food and nutrition pedagogy. As a result of this, the study is set to be the first, if not among the few studies to explore the impact of hybrid learning interventions on food and nutrition pedagogy and specifically within the UAE.

#### *Requirements for application of hybrid learning*

In an attempt to generate the value of hybrid learning to the society, Ibáñez et al. (2012) first identified its primary principles, which include a) a careful integration of both face-to-face learning and online instructional components; b) innovative utilisation of technology in a learning environment; c) reconceptualisation of the learning paradigm; and d) sustainable evaluation and assessment of hybrid learning. Through all these, the first principle is primarily in place to help in enriching the benefits of all stakeholders involved and successfully attain the diverse student needs and preferences. The second principle illustrates the manner in which technology should be applied in a pedagogically appropriate way and in creating and maintaining a socially viable and highly interactive learning environment. The third principle is essential in incorporating new and emerging pedagogies and learning theories like activity theory and constructivism. It also helps in identifying new challenging roles among students and instructors during their interaction. Lastly, the fourth principle is in place to ensure that the required quality standards and effectiveness within the education environment are achieved in a manner that creates value to the whole society.

Zhang et al. (2020) notes that for effective execution of hybrid learning, there must be a general need for such among the stakeholders with an existing view that it offers a superior value proposition than any other learning approach. This forms a vital factor in the effectiveness of hybrid learning, especially in the contemporary world where technology dictates much of the proceedings in different sectors in which all stakeholders must realign their systems and procedures to meet the specific technical requirements within their environment to maintain relevancy. The necessity for hybrid learning in the contemporary world, especially among developed nations, is further presented by the evolution witnessed within the demographic structures. The emergence of the Millenials, technology enthusiast generations highlights the need for all education sectors to reorganise their systems and procedures in a manner that creates value to the current dominating population. Through this, the study highlighted the need for ensuring close consideration of the characteristics of existing demographic structures as well as technological trends before advancing hybrid learning in a specific learning environment.

Similarly, Ukil et al. (2020) largely concurred with the essential requirements advanced by Zhang et al. (2020). However, the study highlighted some additional elements that must be put in place before applying hybrid learning within a learning environment. Some of these include a clear and precise definition of the mission and vision to be achieved within the learning environment and the level of resources available within a specific learning environment. In regards to a clear definition of vision and mission, the study reported that these present the long-term goals and objectives to be achieved within the learning environment. And as such, by defining them precisely, the stakeholders will be in a position to evaluate whether they can be effectively realised through the use of blended learning.

On the other hand, in light of the level of resources available within the learning environment, the study claimed that it considered both infrastructural development and competency among educators as a fundamental strategic framework. Hybrid learning can only be effectively applied in areas with infrastructural development to ensure efficiency and effectiveness. Likewise, regarding competency levels among instructors, the study highlighted the need for individual educators to be able to smoothly interact with different technologically enhanced systems, including web-based educational technology. In case such is not the case, individual educators need to go through proper training to enhance their competency levels. The study concluded that with the enhanced infrastructural systems and increased competency levels among individual educators, there is a need for educational establishments, especially schools to embrace hybrid learning to ensure they remain relevant while delivering services to current and future generations.

Additionally, Yu et al. (2017) also advanced the need to consider the three essential questions before executing a hybrid learning. These included a) who will be leading; b) who will be participating; and c) in what intensity will technology be used. Regarding the first question relating to who will be leading, it is essential to consider the specific stakeholders who will lead the entire learning process. Factors to be considered may include the philosophy that guides their lives as well as their life aspirations and motivations. On the same note, in regards to the second question relating to the participants, it is essential to take into consideration individual participants since hybrid learning is most effective when it is customised to accommodate the explicit needs of an individual student. The specific characteristics like their needs and preferences must be primly considered before choosing a viable hybrid learning model to ensure and enhance the efficiency and effectiveness of the model (Assaad et al., 2018; Lin, 2008). Further, on the last question relating to the level of intensity in which technology will be applied, there is the need to be clear on the ratio at which both traditional learning and e-learning mechanisms will be applied. Through all these, clarity and close consideration of elements involved among stakeholders is also key in ensuring effective integration of hybrid learning hence must be prioritised.

#### *Conditions necessary for application of hybrid learning in food and nutrition pedagogy*

Literacy in food and nutrition is an essential avenue to sustainable human health and the general wellbeing of the world's population. As advanced by Hadjerrouit (2012) and Reiher (2012), there are two sets of knowledge within the framework of food literacy. These include functional and critical knowledge. Functional knowledge primarily involves a broad set of skills that may pertain to food identification as well as mental, physical, and emotional effects of food to an individual, together with the basic abilities related to food. On the other hand, critical knowledge basically allows individuals to perform actions related to food and to reflect on their relationship to the broader food system. The study also advanced the following four critical food literacy objectives that a learning system must be able to impart among learners. These include 1) the ability of an individual to examine their own values with respect to the food system; 2) the adeptness of an individual to comprehend multiple values and perspectives that exists within the food system, which may include diverse cuisines; 3) the proficiency of an individual to generate astute understanding of the larger socio-political context and other factors like the diversity that shape food system; and 4) the capacity for individuals to enhance their commitment towards generating a sustainable food system in a just manner.

Ezeonwu et al.(2014) also advanced that professionals within the food and nutrition sector should possess the appropriate skills and knowledge necessary to plan, manage, prepare and eat culturally appropriate and healthy foods. They should be able to generate a widespread understanding of the different elements involved in the food system, including their local cuisine relatively to those from other cultures in a globalised contemporary world. They should also be able to elicit appropriate change within the food and nutrition system whenever necessary. These form some of the essential factors that must be considered before integrating hybrid learning within the food and nutrition sector.

In a study aimed at exploring the viable conditions that are necessary for the application of hybrid learning, Spring et al. (2019) also concurred with the observations made by Hadjerrouit (2012). At the core of the study's assertion was the need to generate a widespread and more enhanced understanding of an individual's socio-political environment. The study further advanced that in as much as food and nutrition is considered a more private affair, that is not the case for professionals in this area. They should be able to understand the macrosystem within their environment to ensure

appropriate planning of all elements involved. This should not only be aligned towards understanding the political environment and factors related to it like food insecurity but also incorporate other essential environments like the cultural environment. Learners should be able to understand factors like local cuisine within their cultural environment and how they relate with other cultures within the highly globalised contemporary world. Understanding local cuisine is essential, ensuring sustainable human health and the general wellbeing of the population involved through proper planning, management, preparation, and eating.

Shukla et al. (2017) also highlighted that an education system used in food and nutrition pedagogy should be able to ensure a well-structured learning process that takes into account the specific characteristics involving needs and preferences among individual learners. It should also be able to ensure seamless interaction between the primary stakeholders involved to increase their level of understanding through enhanced creativity and collaboration. The system implemented should also be able to enhance the level of information and knowledge management by ensuring increased processing, storage, and retrieval of information. The study noted that all these could be effectively realised from the application of hybrid learning within food and nutrition pedagogy.

## **Methodology**

### **Overview**

Discussion on hybrid learning is increasingly becoming common, especially with the onset of the COVID-19 pandemic. This study sought to establish how hybrid learning is relevant in advancing food and nutrition pedagogy, mainly in UAE and elsewhere, and to establish requirements and conditions necessary for its successful application. This section of the study is a succinct description of the methodological approaches and strategies employed in attaining the purpose of this study. The research design, samples, research instruments used, procedures, and data analysis approaches have been described.

### **Research design**

An exploratory research design has been adopted to guide this study. The design aims at examining problems that have not been extensively studied and lacks thorough investigation (Robson & McCartan, 2016). Thus, its goal is to develop a deeper understanding of an existing phenomenon or problem without necessarily deducing a conclusive result. Hybrid learning is a concept that has surfaced in many countries, including the UAE, and is given prominent importance primarily after the outbreak of the COVID-19 pandemic; hence its applications and implications remain a phenomenon. The goal of a researcher, in this case, is to try gaining familiarity with the concept and its application in food and nutrition pedagogy and acquire new insights into it (Hammersley & Atkinson, 2007). As Costley and Fulton (2018) explain through the grounded theory, the role of an investigator is to examine the veracity of existing facts that lies within the problem under investigation. Data collected are then presumed as objective facts that a researcher can use to develop or verify theories and what they imply. Therefore, exploratory research design, also referred to as the grounded theory approach, is fit for this study since it will guide the development of a theoretical framework for the effective application of hybrid learning in advancing food and nutrition pedagogy.

### **Participants**

This study targeted primarily UAE teachers who teach subjects related to food and nutrition. In the process of collecting data, it was realised that there were only a handful of Culinary Science teachers in the UAE, which prompted the need to collect data from other Culinary Science teachers around the globe. A total of 60 questionnaires were sent out to prospective participants through a JISC online survey link. A total of 24 Culinary Science teachers participated in the survey. Hence the response rate was 40%. Among those who responded, 16 were UAE teachers. The data collection process was limited by time and resources, making access to larger samples difficult. A convenience sampling technique was used to recruit the participants. The researcher recruited participants based on their availability, accessibility, and willingness to participate (Shi, 2007).

## **Research instruments**

Data was collected primarily through an online questionnaire. The questionnaire was designed and distributed to participants using Jisc Online Surveys (Joint Information System Committee). The questionnaire was designed into four critical parts, including demographic information, teachers' preparedness towards hybrid learning interventions, hybrid learning interventions and food and nutrition education, requirements for successful application of hybrid learning in food and nutrition education, and conditions necessary for the successful application of hybrid learning in food and nutrition. The questionnaire was designed based on various concepts and theories as described under the background section and literature review section of this study. Each participant managed to answer all the questions in the questionnaire. The questionnaire had different types of questions which included yes/no questions, five-point Likert scale questions, demographic questions, multiple-choice questions, and open-ended questions (Robson & McCartan, 2016).

## **Research procedure**

The data collection process began with the recruitment of participants and the designing of the online questionnaire. A link to the survey (Jisc Online Surveys) was then generated and distributed to the participants. The Jisc Survey system would then anonymously record every response provided by the participants in tables and provide a basic analysis of the survey outcomes (Swain, 2016). Summarised data in Excel sheets were then downloaded for further and deeper analysis.

## **Data analysis**

Although the survey was used for both deductive and inductive purposes, most of the questions were fixed and had a fixed list of responses that the participants could select from. The fixed nature of the survey implied the use of quantitative data analysis tools in data analysis (Abbott, 2016). SPSS v25 (Statistical Package for Social Sciences version 25) was used as a tool to analyse the data. Descriptive and inferential results were then generated to guide the conclusions and implications of the study. Coefficient alpha was used to test the internal consistency of the data to determine reliability.

## **Results and discussions**

### **Results**

This section of the study contains both the descriptive and inferential statistical results attained after performing an analysis using SPSS. A total of 24 participants successfully completed the survey, out of which there were only two men (8.3%), with the majority (21) being women (87.5%). The remaining 4.2% representing one person, chose not to say their gender. The characteristics of the participants varied significantly by age, educational achievements, period serving as a teacher, and current teaching roles, as evidenced in Tables 2, 3, 4, and 5. More than 45% of the teachers who participated in the survey were aged between 45 and 50. Again 54.2% of the participants were Bachelor's Degree holders. 20.8% were Master's Degree holders while 12.5% held Professional Degree holders. The majority of the participants (37.5%) had been teachers for more than 20 years by the time this study was undertaken. 20.8% had been teachers for less than three years. These statistics imply that the participants were skilled and experienced to inform this study.

Table 2 Characteristics of participants by age (What is your age?)

Age	Frequency	Percent	Valid Percent	Cumulative Percent
Below 20	1	4.2%	4.2%	4.2%
21-25	2	8.3%	8.3%	12.5%
26-30	1	4.2%	4.2%	16.7%
31-35	1	4.2%	4.2%	20.8%
36-40	1	4.2%	4.2%	25.0%
41-45	5	20.8%	20.8%	45.8%
46-50	6	25.0%	25.0%	70.8%
51-55	1	4.2%	4.2%	75.0%
56-60	3	12.5%	12.5%	87.5%
61-65	1	4.2%	4.2%	91.7%
66-70	1	4.2%	4.2%	95.8%
Above 70	1	4.2%	4.2%	100.0%
	<b>24</b>	<b>100.0%</b>	<b>100.0%</b>	

Table 3 Characteristics of participants by age educational achievement

What is the highest degree or level of school you have completed? If currently enrolled, highest degree received	Frequency	Percent	Valid Percent	Cumulative Percent
Bachelor's Degree	13	54.2%	54.2%	54.2%
Doctorate Degree	1	4.2%	4.2%	58.3%
High School Graduate	1	4.2%	4.2%	62.5%
Master's Degree	5	20.8%	20.8%	83.3%
Professional Degree	3	12.5%	12.5%	95.8%
Vocational Training	1	4.2%	4.2%	100.0%
<b>Total</b>	<b>24</b>	<b>100.0%</b>	<b>100.0%</b>	

Table 4 Characteristics of participants by age by experience

For how long have you been a school teacher?	Frequency	Percent	Valid Percent	Cumulative Percent
0-2 years	5	20.8%	20.8%	20.8%
12-14 years	1	4.2%	4.2%	25.0%
18-20 years	4	16.7%	16.7%	41.7%
3-5 years	2	8.3%	8.3%	50.0%
6-8 years	2	8.3%	8.3%	58.3%
9-11 years	1	4.2%	4.2%	62.5%
> 20 years	9	37.5%	37.5%	100.0%
<b>Total</b>	<b>24</b>	<b>100.0%</b>	<b>100.0%</b>	

Table 5 Characteristics of participants by teaching role

What is your current teaching role?	Frequency	Percent	Valid Percent	Cumulative Percent
Assistant Principal	2	8.3%	8.3%	8.3%
Class teacher	1	4.2%	4.2%	12.5%
Food and Nutrition Consultant	1	4.2%	4.2%	16.7%
Food technician	1	4.2%	4.2%	20.8%
Head of Food and Nutrition Dept	4	16.7%	16.7%	37.5%
HE/Hospitality/Food & Nutrition teacher	2	8.3%	8.3%	45.8%
LSE	1	4.2%	4.2%	50.0%
Retired Teacher	1	4.2%	4.2%	54.2%
Head of Science	1	4.2%	4.2%	58.3%
Second Level Teacher	1	4.2%	4.2%	62.5%
Food Preparation and Nutrition	1	4.2%	4.2%	66.7%
Teacher of Food	7	29.2%	29.2%	95.8%
Tourism and Hospitality	1	4.2%	4.2%	100.0%
<b>Total</b>	<b>24</b>	<b>100.0%</b>	<b>100.0%</b>	

## Inferential statistics

### Reliability

The reliability test was completed through the determination of Cronbach's alpha, also known as coefficient alpha. Cronbach's alpha measures internal consistency or how well a test or tool measures what it ought to measure. Generally, an alpha becomes acceptable only if it is at least 0.7. Alphas greater than 0.9 generally have excellent internal consistency. A reliability analysis undertaken for this study generated an alpha of 0.716, implying an acceptable internal consistency.

Table 6 Reliability statistics

Cronbach's $\alpha$	N of Items
.716	24

- Is hybrid learning intervention significant in promoting food and nutrition pedagogy in UAE and beyond?

The first question that this study was interested in uncovering was whether hybrid learning interventions could significantly promote food and nutrition pedagogy in UAE and beyond. During the analysis, it was perceived that approaching the independent variable (hybrid learning interventions) from a holistic approach would be quite perverse and invalid since various factors can form part of hybrid learning interventions. As (Williamson & Johanson, 2017) exclaimed, a variable need to be in its simplest terms to generate a more objective and conclusive outcome. Therefore, individual hybrid learning interventions mentioned in the questionnaire were used as independent variables. The interventions mentioned in the questionnaire were (1) The Ministry of Education in collaboration with schools is responsible for promoting, supporting, and modelling creative and innovative thinking and inventiveness on food and nutrition using digital tools and resources as a way of advancing learning outcomes, (2) Scientific culinary skills can be promoted by engaging students in exploring real-world food and nutrition issues and solving authentic nutrition problems using digital tools and resources, (3) Culinary Science teachers should model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments, (4) Schools should design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity, and (5) Teachers should customise and personalise learning

activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources.

For better presentation, these factors were condensed into the following variables; (1) Innovative thinking and inventiveness, (2) Students' engagement, (3) collaborative knowledge construction, (4) incorporation of digital tools and resources, and (5) customisation of learning activities. A linear regression analysis to determine how each of these hybrid learning interventions affect food and nutrition pedagogy in UAE and beyond generated the results in Table 7. The analysis was done at a significance level of 0.05.

Table 7 Regression Results

Coefficients <sup>a</sup>	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
Model 1 (Constant)	.288	.295		.975	.344
Innovative thinking and inventiveness	.260	.046	.419	5.662	.000
Students' engagement	.135	.048	.246	2.796	.013
Collaborative knowledge construction	.134	.075	.130	1.777	.095
Incorporation of digital tools and resources	.226	.079	.261	2.860	.011
Customisation of learning activities.	.169	.079	.121	2.152	.047

a. Dependent Variable: Food and nutrition pedagogy

From the results presented in Table 7, only one of the five factors did not project a significant effect on food and nutrition pedagogy. Collaborative knowledge construction generated a  $p$ -value of 0.95 ( $p > 0.05$ ), implying its insignificance. In terms of the level of significance in promoting food and nutrition pedagogy, innovative thinking and inventiveness proven to be more significant ( $p = 0.000$ ) consequently followed with the incorporation of digital tools and resources ( $p = 0.011$ ), students' engagement ( $p = 0.013$ ) and customisation of learning activities ( $p = 0.047$ ).

- What special requirements are necessary for the successful application of hybrid learning in the food and nutrition pedagogy?

The second question that this study aimed at finding and ranking responses on the special requirements necessary for successful application of hybrid learning in food and nutrition pedagogy. From the literature reviewed in the previous sections, six-core special requirements were found to be of significance in ensuring successful application of hybrid learning in food and nutrition pedagogy: Leadership, professional development, the right technology, teaching models, a balance between face-to-face methods, and online-based methods, and streamlined organisation of contents and resources. The next step was to rank these requirements with respect to their level of importance. A 1-10 scale (where 1 meant *unnecessary* and 10 *very necessary*) was used to enable the participants to rank the requirements. Measures of central tendency, including mean and standard deviation, were used to perform the ranking. The result in Table 8 was obtained. From the Table, it is evident that all the factors included were very necessary for the successful application of hybrid learning in the food and nutrition pedagogy (all means are greater than 8).

Table 8 The requirements

Descriptive statistics	N	Min	Max	M	SD
Leadership	24	6	10	8.71	1.517
Right Technology	24	8	10	9.71	.624
Professional development	24	5	10	9.37	1.245
Teaching Models to be adopted	24	6	10	8.50	1.319
Balance between traditional face-to-face method and online-based methods	24	5	10	8.62	1.377
Streamlined organisation of contents and resources	24	5	10	8.79	1.444
Valid N (listwise)	24				

- What conditions are necessary for the successful application of hybrid learning in the food and nutrition pedagogy?

In addition to the requirements, this study projected that some specific conditions are fundamental in applying hybrid learning in food and nutrition pedagogy. Seven conditions, as mentioned in Table 9, had been predetermined through the literature reviewed. Again, the conditions were rated on a 1-10 scale. The results in Table 9 were obtained.

Table 9 The conditions

Descriptive statistics	N	Min	Max	M	SD
Teacher literacy and competency in food and nutrition	24	6	10	9.46	1.103
Students' /Learners' preparedness to learn	24	5	10	8.92	1.501
Availability of physical kitchens or cooking labs	24	4	10	8.75	1.726
Virtual cooking labs	24	1	10	7.08	2.827
A supportive school administration	24	8	10	9.29	.859
School-teacher-student collaboration and engagement	24	8	10	9.38	.875
Parental Involvement	24	2	10	7.83	2.140
Valid N (listwise)	24				

## Discussion

The adoption of hybrid learning techniques is increasingly becoming the new normal, especially in a COVID-19 infested world. Although countries such as UAE have perceived the need to shift towards online-based learning, they also realise that a complete paradigm shift is not only unattainable but also impractical and less productive. As research shows and as discussed in prior sections, hybrid learning has a role in promoting engagement, the use of course materials and resources, and deeper and more effective learning outcomes. The results in this study confirm that hybrid learning interventions have a unique place in improving pedagogical outcomes, specifically with respect to food and nutrition pedagogy.

### Impacts of hybrid learning interventions on food and nutrition pedagogy

There is a general consensus among researchers and nutritionists that poor diets, malnutrition, and overnutrition are gradually becoming serious threats to human health and wellbeing and that addressing the problem is central to improving individual wellbeing and development, escalating socio-economic growth, and attaining the Sustainable Development Goals (SDGs) (World Health Organization, 2006). However, low- and middle-income countries rarely focus on addressing diet and nutrition challenges, especially during middle childhood and adolescence (World Health Organization, 2006). As a consequence, children and young adults mature with little or no knowledge concerning sustainable food choices and culinary practices, which eventually imperil their health and wellbeing. This presents a missed opportunity to set up institutionalised systems to address or prevent diet and malnutrition problems (Leahy et al., 2015). Since formal education remains a major priority through which governments spend on school children and adolescents, it is imperative to use this opportunity to promote cost-effective interventions that blend together various aspects of education, nutrition, health, food systems, and technology for more sustainable families and societies. According to (World Health Organization, 2006), school-based food and nutrition education (SFNE) is crucial in building life-long knowledge and skills that would guide individuals and societies towards a more informed life and food and nutrition practices.

It is important to note that ensuring the fluidity of the education system is core to continued learning and greater productivity. The robust building of knowledge and skills in food and nutrition is difficult to attain without a streamlined fluidity in the learning process. However, the fluidity of the learning process is subject to various factors. For instance, the outbreak of COVID-19 crippled conventional face-to-face learning and raised the need for an urgent paradigm shift towards blended and online learning. This study has established four hybrid learning interventions critical in responding to factors that deter fluidity in the learning process; (1) innovative thinking and inventiveness, (2) students'

engagement through both face-to-face technique and distance learning technique, (3) incorporation of digital tools and resources, and (4) customisation of learning activities to meet learning needs. As Woodhouse et al. (2015) exclaimed, the changing educational environment requires a mixture of instructional modalities, media, methods, and technologies across all pedagogical deliverables, without which education will suffer in the face of technology. Needless to say, the social changes, as catalysed by the outbreak of COVID-19, demands the innovativeness and inventiveness of education stakeholders, which would allow teachers and students to interact both physically and virtually. Despite this, teachers involved in this study reported numerous challenges with respect to the four factors mentioned in this section. For instance, the teachers highlighted the lack of technical facilities such as visualisers, projectors, stable internet, and insufficient knowledge in using platforms such as Google Classrooms, Microsoft Teams, Zoom, and Moodle for pedagogical instructions. From the responses, the ability to appropriately balance face-to-face techniques and online-based techniques is generally lacking. Some teachers also shared their fears concerning the threats posed by COVID-19, which limited their preference for face-to-face learning at that particular point in time.

### **Requirements for application of hybrid learning in UAE and beyond**

Effective application of hybrid learning interventions is subject to numerous pedagogical factors. As Ibáñez et al. (2012) had identified, the core principles that drive pedagogical outcomes through a hybrid learning intervention consists of a careful integration of both face-to-face learning and online instructional components, innovative utilisation of technology in a learning environment, the reconceptualisation of the learning paradigm, and sustainable evaluation and assessment of hybrid learning. These aspects clearly emphasise the need for the right technology to weave together face-to-face learning with online-based learning. Zhang et al. (2020) also underlined the need for a strategic proposition that clearly identifies and works towards the attainment of institutional missions, goals, and visions. Such strategic propositioned are tied to the nature of the leadership and its ability to consolidate various operations, tactics, and strategies in order to advance learning outcomes. As quoted in Mugliett (2009), “The pedagogic context should enable teachers to understand how to use ICT in the classroom and to consider how ICT can support and enhance pupil learning as a natural part of the work in the classroom.” In this sense, teachers need to be well informed of the teaching models they adopt, the contents and resources they use to advance pedagogy, and the blending of teaching methods to improve teaching outcomes. This study assessed and ranked such factors amongst others. It was evident that key requirements to effective application of hybrid learning in supporting pedagogical dispensation consist of the following; (a) right technology ( $M = 9.71$ ,  $SD = 0.624$ ), (b) professional development ( $M = 9.37$ ,  $SD = 1.245$ ), (c) streamlined organisation of contents and resources ( $M = 8.79$ ,  $SD = 0.1444$ ), (d) leadership ( $M = 8.71$ ,  $SD = 1.517$ ), (e) Balance between traditional face-to-face method and online-based methods ( $M = 8.62$ ,  $SD = 1.3777$ ), (f) teaching models to be adopted ( $M = 8.50$ ,  $SD = 1.319$ ). In the study, teachers felt very isolated, lack of training, lack of adequate PPE, hard to cope with social distancing as students are always in need of help and assistance during practical activities. Teachers reported problems with flexibility in adapting technology, which they found very daunting. Teachers rarely made efforts to improve their pedagogical expediency, especially with respect to ICT. These findings indicate that the requirements for the effective application of hybrid learning in the UAE and beyond are yet to be met.

### **Conditions necessary for application of hybrid learning in food and nutrition pedagogy in UAE and beyond (social and emotional support)**

According to Reiher (2012), advancing knowledge in food and nutrition requires the development of both functional and critical knowledge that would enable them to integrate concepts of local and broader food systems to generate a deeper understanding of food and nutrition dimensions and systems. In specific, the researcher pointed out some of the conditions he deemed fit for pedagogical advancement, including 1) the ability of an individual to examine their own values with respect to the food system; 2) the adeptness of an individual to comprehend multiple values and perspectives that exists within the food system, which may include diverse cuisines; 3) the proficiency of an individual to generate astute understanding of the larger socio-political context and other factors like the diversity that shape food system; and 4) the capacity for individuals to enhance their commitment towards generating a sustainable food system in a just manner. In this respect, learners should be supported by their microsystem in identifying how socio-economic factors impact and model their food choices. Society has always perceived technology to be having a relative advantage; hence should be used in schools to advance collaboration, engagement, teamwork, and the general

knowledge dispensation process (Muglietti, 2009). This study determined that the specific conditions worth considering in applying hybrid learning in food and nutrition education consists of teacher literacy in food and nutrition ( $M = 9.46$ ,  $SD = 1.103$ ), school-teacher-student collaboration and engagement ( $M = 9.38$ ,  $SD = 0.875$ ), a supportive school administration ( $M = 9.29$ ,  $SD = 0.859$ ), students' preparedness to learn ( $M = 8.92$ ,  $SD = 1.501$ ), Availability of physical kitchens or cooking labs ( $M = 8.75$ ,  $SD = 1.726$ ), parental involvement ( $M = 7.83$ ,  $SD = 2.140$ ), virtual cooking labs ( $M = 7.08$ ,  $SD = 2.827$ ). In addition to these outcomes, these studies established that teachers are very concerned about their low professional relationship and engagement with their students especially owing to COVID-19 policies. This made it hard for the teachers to address their students' academic needs.

The following chart summarises and ranks the requirements and conditions with respect to their means, as presented in Table 8 and Table 9.

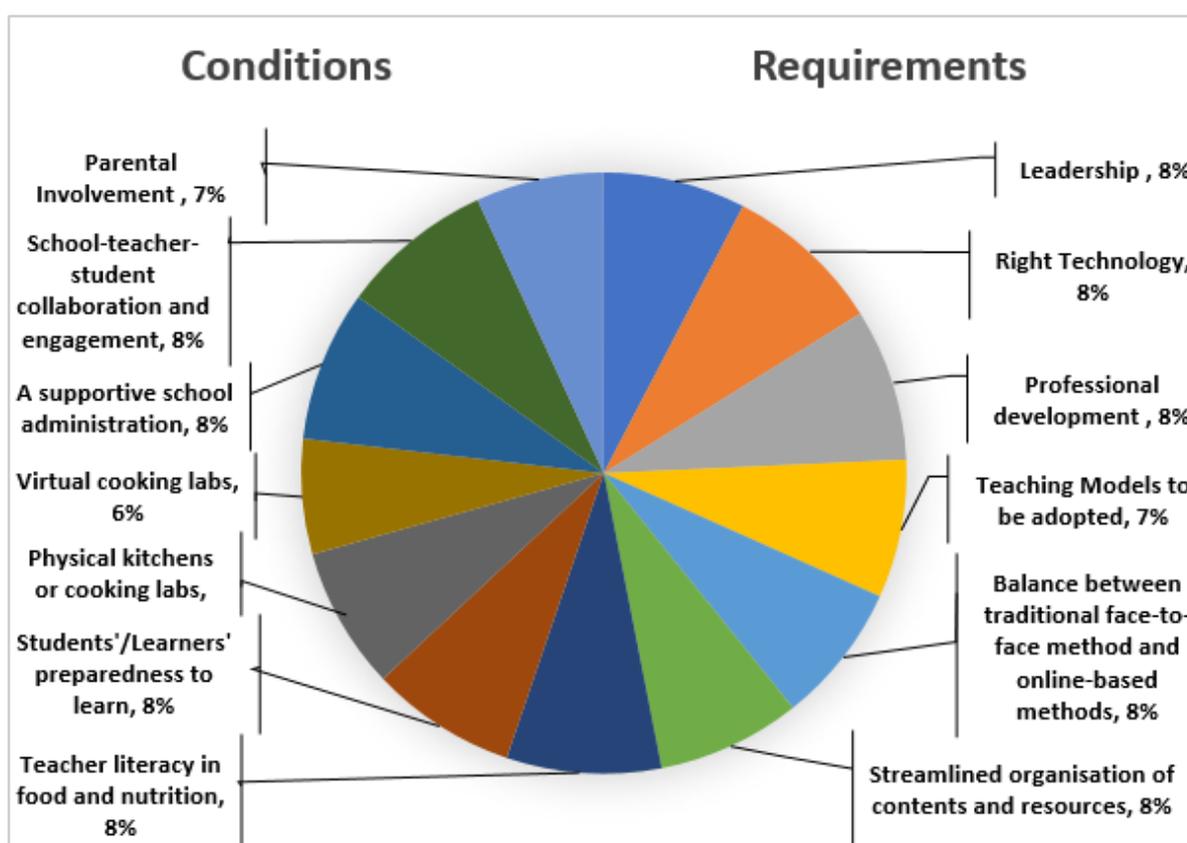


Figure 3 Requirements and conditions affecting the application of hybrid learning

## Conclusions

The goal of this study was to explore hybrid learning as a contemporary approach necessary for advancing food and nutrition pedagogy in UAE and beyond. Using the ecological system theory developed by Bronfenbrenner and the 4GAT theory, it was possible to determine specific factors that influence the learning process. The two theories postulated shared the idea that learning is not only a matter of innate abilities but is also subject to myriad social and environmental factors. In this study, numerous factors that are likely to affect the learning process, especially in a world where technology is increasingly becoming the new normal, have were assessed. The study's objectives were threefold. First, it aimed at determining if hybrid learning interventions are significant in promoting food and nutrition pedagogy in UAE and beyond. Four key hybrid learning interventions shortlisted for this analysis: innovative thinking and inventiveness, students' engagement, collaborative knowledge constructions, incorporation of digital tools and resources, and customisation of learning activities. It was established that four of these factors could significantly promote food and nutrition pedagogy: innovative thinking and inventiveness, students' engagement, incorporation of digital tools and resources, and customisation of learning activities. Despite the

significance of these hybrid learning interventions, the reports provided by the teachers involved in the study signified that they were generally missing in learning institutions. Teachers found it difficult to use blended learning techniques and complained of slow and unstable internet speed, lack of tech facilities to support hybrid learning, insufficient knowledge in using tech resources to advancing pedagogical instruction, and rigidity towards adapting to technology. Such difficulties greatly affect the fluidity of the learning process, making it difficult to adapt to the paradigm shifts towards technology.

Second, this study aimed at determining and ranking various requirements for the successful application of hybrid learning in food and nutrition pedagogy. It was established that the most important requirement is the adoption of the right technology followed by consistent professional development for the teachers, robust leadership, an appropriate balance between face-to-face methods and online-based methods, and teaching methods adopted were also deemed necessary. The requirements as determined in this study calls for the need for schools and other educational institutions to offer technical support, without which the application of hybrid learning in advancing food and nutrition pedagogy will flop. Teachers' slow take-up of technology also presented itself as a significant challenge in the application of hybrid learning. Teachers shared the difficulties they experience with creating online content and engaging with their students both synchronously and asynchronously. This generates the need for well organised professional development specifically with respect to ICT integration and use in pedagogical processes.

Finally, the study focused on establishing conditions that are necessary for promoting the application of hybrid learning in advancing food and nutrition pedagogy. Teacher literacy on food and nutrition was found to be the most important condition, followed by close collaboration and engagement among school administration, teachers, and students. The three areas that were tested in this study led to a formulation of a model to guide the effective application of hybrid learning interventions in advancing food and nutrition pedagogy.

### **Implications**

This study generated numerous implications. First, the educational establishments, in collaboration with schools, have a responsibility to promote, support, and model creative and innovative thinking and inventiveness on food and nutrition through the use of digital tools and resources to advance learning outcomes. Second, students' engagement in exploring real-world food and nutrition issues and solving authentic nutrition problems using both conventional and technological techniques should be supported. Third, the school has a responsibility to incorporate appropriate digital tools and resources to support the learning process and creativity. Fourth, teachers ought to assess their students' learning styles, working strategies, and abilities and customise the learning process in a manner that best addresses these differences. Additionally, there are various requirements and conditions that are necessary for promoting the effective application of hybrid learning in advancing food and nutrition pedagogy, as outlined in the formulated model.

It is important to delineate that the relevance of the hybrid learning interventions as determined in this study is not limited to the context of UAE but are also applicable to other countries across the globe. The role of education systems and establishments across the globe in promoting, modelling and supporting creativity and innovativeness is undebatable. Education systems across the globe must always scale up their game to ensure that learners are exposed to real-world issues and problems and not just the local aspects of them so as to develop a worldview approach to those problems. As COVID-19 continue to ravage societies, the integration of technological options to conventional learning methodologies is fundamental in guaranteeing the goals of contemporary education systems. Even as the world shift towards the new paradigm where online-based learning and hybrid learning are becoming new normals, teacher literacy, students' preparedness to learn, supportive school administrations, collaboration and engagement, and parental involvement will still continue to underpin learning, thus, a shift towards hybrid or online-based learning can never be fully sufficient unless appropriately supported with robust leadership, the right technology, professional development and appropriate teaching models.

This study was limited by a small sample size, which reduces reliability. However, it is also important to note that people engaged in the study were professionals with greater insight into hybrid learning and food and nutrition fields. Future research should expand the sample size and expound on how the model formulated in this study can be used to further CSNE in all schools.

## Author biography

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