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Distance Education in Nutrition and Dietetics Education over the Past 30 Years: A Narrative Review



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ABSTRACT

The coronavirus disease 2019 pandemic necessitated the use of distance education, which sparked a technological transformation that was long overdue in higher education. The purpose of this narrative review is two-fold: to summarize the state of knowledge regarding distance education in nutrition and dietetics education over the past 30 years to inform recommendations for future education/research and implications for practice and to determine the influence that distance education has had on the knowledge, skills, and attitudes of both nutrition and dietetics educators and their students. A narrative review of 822 publications yielded 25 that met the search criteria. In the scope of 30 years, the literature shows that attitudes and perceptions of distance education have changed as barriers to online access have diminished and the availability of online nutrition and dietetics courses and Accreditation Council for Education in Nutrition and Dietetics-accredited distance education programs has expanded. However, whereas the limited results are promising, the paucity of large-sample research about the use of distance education in nutrition and dietetics education restricts educators' knowledge of and ability to evaluate the learning outcomes of distance programs and courses. Moreover, differences in how accreditors, government agencies, and institutions define distance education could have significant influence on funding and financial aid benefits for students and research. Recommendations for future research and implications for practice are provided given the relevance and importance of distance education to nutrition and dietetics education.

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DURING SPRING 2020, THE CORONAVIRUS DISEASE 2019 (COVID-19) pandemic transformed higher education by putting distance education front and center. This technological transformation challenged the traditional lecture-based brick and mortar model that has been in place in higher education for hundreds of years.¹ During fall 2019, a total of 36.3% of undergraduate and 42.3% of graduate students were taking distance education courses² in the United States. A year later (fall 2020), 73% of students in postsecondary institutions were enrolled in distance education courses.³ As COVID-19 recommendations changed, so did course delivery and expectations for both educators and students.

Like all educators, nutrition and dietetics instructors were required to transition to online course delivery within a very short time, with most having minimal training and experience in online course development and teaching.⁴ The unexpected transition to online course delivery negatively influenced many students, including dietetics students who were already stressed by the effects of the COVID-19 pandemic. A cross-sectional online survey was conducted between February and March 2021 to examine dietetics students' perceptions of the COVID-19 pandemic's influence

on academics and mental and physical health.⁵ The dietetics students who participated (n = 526) were enrolled in either a Didactic Program in Dietetics (DPD) or Coordinated Program in Dietetics for both fall 2020 and spring 2021. The survey was distributed to all DPD and Coordinated Program in Dietetics directors listed on the Accreditation Council for Education in Nutrition and Dietetics (ACEND) website in February 2021. Survey results reported that students took 78% of their courses online during the fall 2020 semester. During this semester, 87% of dietetics students experienced increased stress, 64% reported mental health concerns, and 32% reported disordered eating due to the COVID-19 pandemic. In terms of academics, the majority of students agreed that COVID-19 negatively influenced the quality of their education and reported that they learned less during fall 2020 than normal. However, the majority of students also agreed that their program met their education needs and that DPD courses could be taught effectively online or remotely. Although positive results for students receiving online education during the pandemic may have included reduced commuting costs, reduced stress related to potential COVID-19 exposure, and higher grade point averages,⁵ initial findings among health professions students highlight the

negative mental and physical health effects of this rapid and unexpected transition to online education.⁶⁻⁹

It is important to differentiate this rapid and unexpected transition to online education from intentional, well-planned, and well-supported online education.¹⁰ The concept of distance education has been around since the 19th century, and the definition has evolved alongside advances in technology.¹¹⁻¹⁵ Distance education in the field of dietetics began in the 1970s with the delivery of continuing education lectures using a telephone network.¹⁶ The definition of distance education has changed over time due in large part to the advancement of technology, especially during the early 1990s with the availability and increased access to personal computers and public access to the World Wide Web beginning in 1993. Most distance education today is done online and the term *online learning* is often used when what is meant is online education, which better encompasses both teaching and learning aspects.¹⁷ This article uses the term *distance education* because the review covers preonline programs. Reflecting the differences in terminology and technology, the Department of Education amended the Higher Education Act of 1965 (effective July 1, 2021) to establish that distance education is distinguishable from correspondence courses because correspondence courses do not provide regular and substantive interaction.¹⁸

For the purposes of this review, distance education is defined by Open State University of New York/Integrated Postsecondary Education Data System (IPEDS) as:¹⁵

Education that uses one or more technologies to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor synchronously or asynchronously. Technologies used for instruction may include the following: Internet, one-way and two-way transmissions through open broadcasts, closed circuit, cable, microwave, broadband lines, fiber optics, satellite or wireless communication devices; audio conferencing; and video cassette, DVDs and CD-ROMs, if the cassette, DVDs, and CD-ROMs are used in courses in conjunction with the technologies listed above.

In 2022, there were 29 accredited distance education nutrition and dietetics education programs: three associate of applied science programs, four bachelor of science degrees with one program offering both a bachelor of science and a master of science degree, and 22 graduate programs, of which half are Future Education Model graduate degree programs. ACEND defines distance education as: “the delivery of 50% or more of didactic courses in the professional curriculum where students are separated from instructors and learning synchronously or asynchronously through live or recorded media.” It is anticipated that growth in distance learning in higher education will continue to outpace total enrollment growth given students’ demands and preferences, program affordability, and increased accessibility to higher education.¹⁹ During fall 2021, the National Council for State Authorization Reciprocity Agreements released findings from a voluntary study of State Authorization Reciprocity Agreements-participating institutions (n = 2,200) and found that 59% of these institutions plan to continue some or all of their emergency remote learning offerings via distance

RESEARCH SNAPSHOT

Research Question: How has distance education in nutrition and dietetics education evolved over the past 30 years? Has distance education had an influence on the knowledge, skills, and attitudes of nutrition and dietetics students and educators?

Key Findings: During the past 30 years, the attitudes and perceptions of distance education have evolved as barriers to online access have diminished, and the availability of online courses and accredited distance programs has expanded. However, there remains a paucity of research about the use of distance education in nutrition and dietetics, and its influence on knowledge, skills, and attitudes of both nutrition and dietetics students and educators.

education after the pandemic.²⁰ As a result, there will be more demand on faculty to develop distance courses and/or programs that will have a significant influence on nutrition and dietetics education.

OBJECTIVES

The purpose of this narrative review is two-fold: to summarize state of knowledge regarding distance education in nutrition and dietetics education over the past 30 years to inform recommendations for future education/research and implications for practice and to determine the influence that distance education has had on the knowledge, skills, and attitudes of both nutrition and dietetics educators and their students.

METHODS

To gather a complete picture of the literature in the field, the authors conducted a search across five major electronic databases used in the health/dietetics and education fields, which included a mix of US government-provided and library-subscribed databases. Electronic database searches were conducted in January and February 2022 in the following five databases: PubMed, the Cumulative Index to Nursing and Allied Health Literature Plus with Full Text (Ebsco), CAB Direct (Nutrition and Food Science and CABI Direct subscriptions), Medline with Full Text (Ebsco), and the Education Resources Information Center (Ebsco).

Search terms were refined as the research objectives were finalized. For each database, the relevant controlled vocabulary was documented and included in a mix of subject and keyword searches, including medical subject heading terms where available. Combinations of the search terms used in the database searches are listed in [Figure 1](#).

Where possible, search results were filtered to exclude publications from outside the United States and published before 1990. Not every database had reliable geographic filters, so many non-US articles were included in the final list and later excluded during the article selection process. The rationale for excluding articles before 1990 was based on the fact that the Internet was not made public until 1993 and functionality and access to personal computers was limited. Once duplicate and pre-1990 publications were removed, a total of 822 articles were identified by the search process.

Dietetics education	Online education	Higher education
Dietetics; dietetic	Online learning; online courses	Colleges and universities
Nutrition education	Distance teaching; distance learning; distance education (or education, distance)	Graduate; graduate education; education, masters; graduate study
	E-learning; electronic learning	Undergraduate; undergraduate education; undergraduate students
	Computer-assisted education; computer-assisted instruction; computer-assisted learning	Vocational education
	Correspondence courses	Education, professional
	Internet-based education	Continuing education
	Electronic mail	Internship; intern
		Coordinated program
		Didactic program

Figure 1. Search terms used to identify articles for inclusion in the narrative review.

The next step was to screen the list of publications for inclusion in or exclusion from the narrative review. To address the research objectives, the research team determined a set of criteria by which to evaluate each publication for inclusion or exclusion in the data analysis. Generally, the inclusion criteria sought English-language studies or reports about nutrition and dietetics programs for undergraduate/graduate/professional students that applied distance education methods in the United States.

Research publications, reviews, and reports were included. The database search results returned several conference abstracts describing research projects without full publications. Due to the lack of information about their research process, the abstracts were excluded from the data analysis of the narrative review process.

Publications about professional and/or higher education courses and programs for dietetics students in the United States were included. Publications about classes mixed with general education students were allowed only if the course was required for undergraduate or graduate nutrition and/or dietetics majors. Publications about nutrition interventions or continuing education for nutrition and dietetics practitioners were excluded.

After discussion about the evolving nature and definitions of distance education, the team determined that to be included as a distance education-focused publication, the course or program studied in the research publication must fit the Open State University of New York/IPEDS distance education definition (see above). This excluded publications about mail-based (not e-mail based) distance learning courses.

With these criteria as a guide, the title and abstract of the 822 publications were independently screened by at least two of the research team's subject matter experts to include, exclude, or "maybe include" each article. Where the two initial reviewers disagreed on inclusion/exclusion or a publication was marked "maybe" by one or more of its initial

reviewers, the publications in question were marked for full-text review.

Most publications (790 publications) were removed in the initial review because they fell outside scope of the narrative review. The inclusion/exclusion review process found that many of the publications included non-US subjects or described nutrition interventions (not higher education-level courses or programs), which were excluded.

A total of 33 publications underwent a full text review by all four subject matter experts on the research team, yielding 25 publications identified for inclusion in the narrative review. The reasons for excluding eight of the remaining publications were because either the target population did not meet the inclusion criteria, or no distance education was used. The results of each stage of the inclusion review process are depicted in [Figure 2](#).

DISCUSSION

General Characteristics

The 25 publications included in this narrative review are summarized in the [Supplemental Table](#).²¹⁻⁴⁵ Publications were grouped based on major themes and in chronological order: Distance Education Then and Now, Effects of Computer-Assisted Instruction on Learning, and Outcomes Assessment Using Distance Education. The review spanned 30 years with articles from each decade represented as follows: five publications from the 1990s, 12 publications from the 2000s, four publications from 2010s and four publications from the current decade. These publications included four definitions of distance education with 19 synonymous terms. The number of synonyms was similar to findings reported by Singh and Thurman¹⁷ in a systematic review of the definitions of online learning (1988-2018, ERIC database), which yielded 46 definitions with 18 synonymous terms from 37 resources.



Figure 2. Screening process to identify articles describing distance education in nutrition and dietetics education in the United States.

Distance Education Then and Now

The research shows that attitudes and perceptions of distance education changed as barriers to online access diminished and the availability of online courses and accredited distance programs expanded. From 1995 to 2005, there was a 10-fold increase in the use of distance education based on a survey of directors of Commission on Accreditation/Approval for Dietetics Education (CAADE)-accredited undergraduate programs.^{21,22} Approximately 32% ($n = 150$) of undergraduate dietetics programs were offering distance education courses in some format in 2005, although none of the surveyed institutions offered a complete undergraduate DPD program online. Then, in 2021, the COVID-19 pandemic forced the use of distance education in the form of emergency remote teaching,¹⁰ defined as a temporary shift of instructional delivery to an alternate delivery mode for all dietetic education programs in the United States, including an undergraduate and graduate dietetics program at New Mexico State University.²³

Access to computers and comfort in their use has increased significantly over the past 30 years as well. In the late 1990s, among the first studies to examine these factors utilized a self-administered questionnaire to assess differences in computer experiences between students enrolled in a dietetics distance education program and their preceptors.²⁴ The study found that computer access for students at home (24%) was lower than the national average (35%) with only 46% of students and 49% of preceptors in the study having access to a modem and the Internet. Still, overall attitudes toward computers were relatively positive, especially among preceptors.

In the late 1990s and early 2000s, delivery of distance nutrition courses using an e-mail component or an electronic listserv were found to increase the communication between students, faculty, and/or preceptors.^{25,26} In the early 2000s, 2 studies of distance dietetic internship programs^{27,28} observed improvements in attitudes toward online delivery, including findings that dietetic interns who preferred to work collaboratively took advantage of online instruction opportunities more often, time spent using online instruction positively

influenced attitudes toward computer use, and Internet use improved regardless of whether online instruction was available.

Distance education continued to evolve with technological advances. The 2005 survey of CAADE-accredited programs found that the most common distance education dietetics course offered was a basic or introductory nutrition course (31%) and 48% of distance education courses were offered as 100% Internet (ie, online) courses.²² The use of Blackboard (Blackboard, Inc)—a learning management software designed to deliver an online course—was described by Farrior and Gallagher in 2000²⁹ and found that although enrollment increased by 15% in the two online courses described, student course evaluations rated interaction between student and instructor as low. Benefits of online course delivery reported included convenience, timeliness, and ease of access.

In 2007–2008, 9.5% of graduate students were enrolled in an online graduate program nationally.² With the onset of the COVID-19 pandemic, 7 million postbaccalaureate students were exclusively enrolled in distance education courses in 2020 compared with 2.4 million in 2019; a 186% increase from the previous year.⁴⁶ A 2007 invited review described good online programs as those that offer an advanced degree and are experienced in online education, positively regarded, and housed within an accredited institution. This review also described the characteristic of successful online students as those who are self-directed, flexible, committed, and self-disciplined.³⁰ Distance education has evolved to focus on a student-centered approach that creates regular and substantial interaction among peers and instructors. In 2019, the online vs in-person delivery of courses was assessed by collecting perceptions and opinions of graduate clinical nutrition students ($n = 176$; 32.8% response rate) at a midwestern university. Results indicated that perceptions varied and were dependent on individual learning style.³¹ Students perceived a synchronous delivery mode to have significant benefits for learning, networking, and professional development due to the structure, connection, and real-time interaction supported by this model. An evaluation of student outcomes using multiple assessment methods (capstone experience,

oral comprehensive examination, and e-portfolio) showed enhanced learning, synthesis of information, and readiness to contribute as a member of the health care team.

Influence of Computer-Assisted Instruction on Learning

Computer-assisted instruction (CAI) is an interactive instructional technique that uses technology in the form of computers and software application to teach concepts or skills to enhance the learning process. CAI can be embedded into an in-person course or used as a supplemental tool to enhance the learning process. The use of CAI to enhance or supplement in-person education was evaluated by eight publications included in this narrative review.^{32–39} Collectively, these studies consistently showed equivalent or better outcomes for students participating in CAI when compared with students not participating in CAI.^{32–39} The use of CAI as a supplement to lecture consistently led to equivalent or better grades/performance on knowledge exams.^{32,33,35} The use of CAI was shown to enhance clinical reasoning skills, improve students' abilities to choose counseling approaches,³⁶ and increase knowledge on nutrition-focused physical exams.^{35,37} CAI was also used to enhance student education on diabetes mellitus and the Nutrition Care Process.³⁹

Overall, students' attitudes toward the use of computers were positive across studies. Students reported that CAI programs were useful, reinforced and reviewed lecture materials, and helped them improve their grades.³³ Students' responses to CAI or interactive learning assessments were measured in five of the eight publications and all reported that students responded positively to the use of CAI. However, care must be taken when designing CAI programs. When CAI was first introduced, some students reported not knowing how to use the CAI programs.³³ Whereas unfamiliarity with technology may be less prevalent than it was 20 years ago, CAI use still requires a level of technological awareness.

Outcomes Assessment Using Distance Education

Over a 20-year period (2002 to 2021), six publications reported on outcomes of distance education programs for students (student learning outcomes) or for graduates (program outcomes). Two of the six publications were interrelated with one describing the four key steps required for development and approval of a pilot master of public health nutrition degree program using distance education (which took 5 years to complete) and the follow-up study assessing the outcomes of the pilot program.^{40,41}

Program Development and Program Outcomes. The assessment of the outcomes of a distance-based pilot master of public health nutrition degree demonstrated that it is possible to deliver a CAADE-accredited Graduate Coordinated Dietetics Program with the ability to earn a master of public health degree using distance strategies.⁴¹ It was reported that nine out of 10 graduates of the program were promoted within a year after graduating with their master of public health degree. Low enrollment and a greater attrition rate were found to be issues when compared with the residential program. A second publication compared program outcomes

for distance dietetic internships ($n = 5$) vs traditional, in-person dietetic internship ($n = 7$).⁴² The results of this study did not support equivalency in preparedness of graduates. Preparedness based on ability to communicate, provide nutrition therapy, clinical judgment, independence, and work ethic were rated higher on graduate surveys by in-person graduates and their supervisors with no difference noted between in-person graduates and distance graduates on ability to counsel patients and ability to manage foodservice systems. The in-person dietetic internship programs were matched to participating distance dietetic internship programs based on size, geography, institution type, and emphasis area.

Student Learning Outcomes. Three publications evaluated student learning outcomes for students enrolled in online dietetics programs with two of the three collaborating with other dietetic programs. All three showed a positive influence of distance learning that included improvement on key-feature pre- and posttest exam scores in nutrition support and pediatric nutrition for students enrolled in three different online dietetic internship programs with posttest scores of nutrition support calculations more predictive of performance on the registration exam for dietitians,⁴³ significant improvement from baseline in eight of 11 research skills in an online nonthesis master's program based on students self-report of skills and interest in research before and after completing a four-course research curriculum,⁴⁴ and demonstrated skills development in systems thinking assessed by subject matter experts and more confidence in ability to perform learning outcomes as reported by learners who completed an optional online three-part webinar series from dietetic internship programs and coordinated graduate programs at four university sites.⁴⁵

The influence of distance education on program outcomes and student learning outcomes in dietetics largely parallels results seen in other health science fields. Several systematic reviews have reported that students enrolled in health science distance education programs perform modestly better or no differently than those enrolled in traditional face-to-face instruction with no difference in professional skills or behaviors once students enter the workplace.^{47–49} Particular to dietetics education, ACEND holds both distance and in-person programs responsible for the preparedness of graduates. Through accreditation, both types of programs are held to the same standards and are required to ensure that experiences are comparable and lead to the equivalent preparedness of graduates for entry-level practice. Thus, if conducted properly, distance education can lead to equivalent or superior student outcomes while providing students with additional flexibility and opportunity, especially for nontraditional students.^{48,49} However, the barriers to distance education should not be overlooked. Technical problems; poor pedagogical design; low self-efficacy; and limited access to required technology, especially for students from less privileged socioeconomic backgrounds, can all impede the effectiveness of distance education programs.^{47,49} To succeed in effective distance education, universities should invest in proper information technology infrastructure and technical support to ensure that all students have access to the technological resources needed. Universities should also train distance education instructors in best practices in online

education to ensure that instructors develop the pedagogical knowledge, communication skills, and digital literacy necessary to support students in a collaborative, online environment. To this end, the 2022 ACEND Standards include the evaluation of distance education programs that address the need for faculty training and support on distance learning technology and distance education pedagogy to ensure effective teaching. To develop an effective distance education program, instructors must be trained to support students in the online environment, which often requires students to have greater independence, motivation, and time-management skills.⁴⁴

Distance Education in Medical and Health Professions Education

A review of distance education in medical and health professions education provides guidance to nutrition and dietetic educators in assessing the influence of distance learning on professional preparation as well as facilitate research studies in dietetics practice and education. For example, in 2015, the National Council of State Boards of Nursing published a white paper: "Nursing Regulation Recommendations for Distance Education" that reflected the National Council of State Boards of Nursing's Distance Learning Education Committee recommendations for distance education prelicensure programs that is relevant to nutrition and dietetics.⁵⁰ Recent research shows best practices for effective implementation of online teaching and learning in medical and health professions education.^{51,52} Two studies showed nursing student's perception of online learning and its influence on knowledge, whereas others showed factors affecting student engagement in online learning among health science and medical students.⁵³⁻⁵⁶ In addition, Car and colleagues⁵⁷ identified research gaps and priorities in distance health professions education. Data from these studies may be adapted to facilitate research in dietetics practice and education.

SUMMARY AND FUTURE RESEARCH

Many of the issues related to delivery of distance education; that is, access to and comfort with computers, have been improved and/or resolved with the Information Age and advancement of technology. Distance education has moved online and thus much of the conversation about distance education is now centered around online education, especially online learning. There are differences in how accreditors, federal, state, and/or local agencies and institutions define distance education and related terms such as hybrid/blended courses. These differences could have significant influence on funding financial aid benefits for students and research. This includes student visa status, which affects access because international students on F1 visas are only able to take one online course per semester while in the United States.⁵⁸ Thus, a standardized definition of distance education and related terms is needed. For future research, it is recommended that the definition for distance education reflect two major components: delivery of education using one or more technologies when teacher and student are separated and regular and substantive interaction between the student and the instructor must occur.

In 1995, data showed that distance education in dietetics education was provided on a limited basis.²¹ ACEND's Accredited Programs Directory classifies programs that provide coursework and/or rotations entirely online as distance education programs. Although the number of ACEND-accredited distance education programs has increased, there is no information about programs that utilize some form of distance education but do not meet ACEND's definition of a distance education program.

Given the technological transformation that has occurred in higher education due to the COVID-19 pandemic, the value of intentional, well-planned, and well-supported distance education has been realized. In 2020, Research and Markets reported that the growth of distance education is predicted to increase at a compound annual growth rate of 9.23%, reaching \$319.167 billion by 2025.⁵⁹ Currently, there are 293 distance education programs for regionally and nationally accredited nutrition master's degrees nationwide, some of which are also accredited by the Accreditation Council for Nutrition Professional Education or ACEND, compared with <50 in 2014.⁶⁰ The demand for distance education has had a significant influence on expected competencies of nutrition and dietetic educators reflecting advances in education since 2009 and are included in the revised 2018 Standards of Professional Performance for Registered Dietitian Nutritionists (Competent, Proficient, and Expert) in Education of Nutrition and Dietetics Practitioners.⁶¹ Thus, it is critically important that nutrition and dietetic educators be knowledgeable and skilled in applying best practices in the delivery of quality nutrition and dietetics education and utilize technological advancements undergirded by education theory to meet the increasing demand for distance education in higher education.

After COVID-19 forced faculty and college students to move teaching and learning online, the disparities between students with and without reliable access to the Internet and/or computers became more visible uncovering a major issue of equity and access for students. Although it is reported that 97% of the American population owns a computer, access to reliable broadband service is problematic for low-income and rural Americans. The Biden administration has earmarked \$100 billion to bring affordable Internet to "all Americans" by 2029.⁶²

Despite the very limited number of publications using CAI and/or computer-based simulation in nutrition and dietetics education in this review, all demonstrated at least equivalent if not improved student learning outcomes and when measured were well received by students. There is limited research on perceptions and attitudes of nutrition and dietetics educators use of CAI and/or simulation. The challenges of using CAI need to be considered and include technology comes with a cost, the investment in time is significant, and the content and/or the technology itself can become outdated. CAI should be used to enhance learning but not as a replacement for the instructor. Potential applications and benefits of CAI and/or simulation can provide nutrition and dietetics students with increasing levels of complex real-life experiences to assess and improve clinical reasoning skills, the ability to problem solve, and the development of higher order thinking skills such as system thinking. This could have a significant influence on the preparation of students for supervised practice/experiential learning allowing students to feel more confident and progress at a higher rate and level in terms of knowledge and skill. In addition, exposure to complex conditions and/or advanced practice level registered

dietitians would be possible for students in remote areas or who are working in smaller community hospitals.

Although there were only two interrelated studies that reported on the feasibility and success of delivering an accredited coordinated graduate (ie, master of public health degree) program, continued accreditation status of ACEND-accredited distance education programs in nutrition and dietetics provides evidence that quality distance education programs within nutrition and dietetics education exist despite limited research and reporting. The number of ACEND-accredited distance education nutrition and dietetics programs has increased yet they represent only 4.6% of the number of ACEND-accredited nutrition and dietetics education programs.

There was limited research regarding the influence of distance education on student learning outcomes in nutrition and dietetics education. Again, this was not true outside of nutrition and dietetics education. Although statistically significant and considered modest (an average effect size of +0.20 favoring online conditions), the most cited and well-respected meta-analysis funded by the US Department of Education found that student achievements of learning outcomes were better for online learning as compared with the traditional format.⁶³ Results do not suggest that online learning is superior, but the measurable differences found were attributable to time spent, curriculum, and pedagogy used in the online format.

CONCLUSIONS

The paucity of research about the use of distance education in nutrition and dietetics education persists today. There were only seven publications related to distance education in nutrition and dietetics education in the past decade. Moreover, there was a lack of research on the influence that distance education has had to date on the knowledge, skills, and attitudes of nutrition and dietetics students and even less so on nutrition and dietetics educators.

Recommendations for future research include:

- supporting research on distance education and emerging technologies to ensure the provision of high-quality nutrition and dietetics education in the preparation of competent nutrition and dietetics practitioners and continuing professional education;
- identifying models for distance learning research used in other medical professions that could provide guidance to nutrition and dietetics practitioners going forward to assess the influence of distance learning on professional preparation and facilitate research studies in nutrition and dietetics education and practice;
- surveying on the attitudes of nutrition and dietetics students, educators, and preceptors regarding distance education and the use of distance education in dietetics should be conducted on a regular basis (every 5 years) to better assess the progress of distance education and need for education, training, and resources;
- determining of predictors of success when designing, implementing, and evaluating distance education at the program and course level with the purpose of establishing quality standards and best practices for distance education in the field of nutrition and dietetics; and

- examining the use of current and emerging technologies (CAI or computer-based simulation) as part of effective online instruction strategies to better prepare students for supervised practice/experiential learning and maximize learning given the shortage of preceptors and clinical sites.

The significant increase in the use of distance education in dietetics education programs as well as the advancement of technology over the past 30 years was reflected by the publications included in this review. In the scope of 30 years, the research showed that attitudes and perceptions of distance education changed as barriers to online access diminished and the availability of online courses and accredited distance programs has expanded. The importance of having well-trained and skilled nutrition and dietetics educators who have the ability to effectively utilize distance-based technology in the delivery of high-quality online nutrition and dietetics education has been identified in the 2022 ACEND Standards. However, the benefits of the use of high-quality distance-based education are not well documented in nutrition and dietetics education, thus more research is required.



PRACTICE IMPLICATIONS

The mission of the Accreditation Council for Education in Nutrition and Dietetics (ACEND) is to ensure the quality of nutrition and dietetics education to advance the practice of the field. Fostering innovation in nutrition and dietetics education is among ACEND's strategic goals. To ensure the quality of distance education in nutrition and dietetics education:

- Nutrition and dietetics educators will need to be skilled in utilizing educational theory and best practices in distance education to provide high quality learning experiences for students and ensure competencies are met based on ACEND standards while meeting the increasing demand for distance education in higher education.
- Nutrition and dietetic educators will need to be supported in the scholarship of teaching and learning with emphasis placed on distance education given the expected growth in online course and program delivery.
- The reasons for the lack of research in distance education in nutrition and dietetics education need to be identified and the degree of their influence so that strategies can be developed, including collaborative opportunities to support educational research and the scholarship of teaching and learning.
- Utilize expertise of ACEND-accredited program directors and nutrition and dietetics faculty members experienced in distance education to establish quality standards for distance education in nutrition and dietetics education.

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J. Bueche and K. Stote conceived the idea and identified research objectives. J. Bueche took lead on writing the manuscript. J. Jensen directed the search and wrote the methods section of the manuscript. Subject matter experts J. Bueche, K. Martin, E. Riddle, and K. Stote collectively cross-checked articles for exclusion or inclusion and summarized content from articles. All authors reviewed subsequent drafts of the manuscript.