

Review

Current Interventions for the Digital Onboarding of First-Year Students in Higher Education Institutions: A Scoping Review

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Abstract: Every year, students around the globe embark upon their higher education journey, making the onboarding of these students a critical task for colleges and universities. Combined with the growth in distance learning and the rapid development in technologies, the onboarding process occurs increasingly in the digital setting. For this reason, the objective of this scoping review was to report and map interventions, which are used in digital onboarding of first-year students in higher education institutions and explore the digital settings that characterized these interventions. The PRISMA-ScR Guidelines and the JBI Manual for Evidence Synthesis guided this investigation, which included researching four databases and screening the resulting titles and abstracts to identify the 17 sources of evidence included in the final analysis. According to our results, digital and virtual onboarding interventions were categorized into four onboarding dimensions: information interventions, socialization interventions, counseling interventions, and self-study interventions. Examples of the purposes and outcomes of these onboarding interventions included the transfer of information and the socialization of incoming students. Of the five onboarding settings that were also identified in the categorization, telecommunication software and virtual environments predominated. An independently developed onboarding tool could combine the identified onboarding settings and dimensions in the future.

Keywords: digital onboarding; interventions; virtual settings; first-year students; scoping review



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1. Introduction

Every year, colleges and universities around the globe welcome a multitude of new students to their institutions of higher education. While this influx of learners marks a new beginning for these institutions, the incoming students also face an ending in terms of their school life, along with the commencement of their tertiary education [1]. This transition between a school and a higher education institution can be challenging, as many of the incoming students may be subject to increased stress because of the need to adapt to a new environment and a new lifestyle [2]. Furthermore, previous research indicated that incoming students experienced increased health problems and lower well-being in their first year of university or college compared to their earlier school life, making this time period especially important for these institutions to address [3]. Adjustment-related stress in first-year students has been associated with high dropout rates of these students after arriving [4]. Thus, this adjustment phase—also referred to as onboarding [5]—is an important procedure for higher education institutions to protect and hold their new students. The process comes with a multitude of requirements that have already been strongly associated with the intention to remain in institutions or companies [6]. The onboarding process involves deliberate interactions between the newcomer and the institution within which the newcomer needs to be integrated [7]. Onboarding interventions are used to support this interplay in multiple ways. These onboarding interventions are actions that have been planned beforehand to help the newcomer become integrated into the new environment [8].

Examples of onboarding interventions in higher education institutions include peer-to-peer mentoring or informal evening programs [9]. Such onboarding interventions have generally been applied in face-to-face settings, building on the basis of allowing incoming students and institutional staff to meet in person [5]. However, the rise in digital distance learning has decreased this possibility [10], along with the legal limitations on physical interaction due to the COVID-19 pandemic [11]. Accordingly, higher education institutions must find new ways to provide effective onboarding interventions to their incoming students. Digital solutions, such as virtual environments [12], or relying on telecommunication software for the onboarding of incoming higher education students [5] may be the future. Nevertheless, these types of digital solutions for onboarding interventions are new and require extensive investigation in order to be relied on by higher education institutions—and their incoming freshman classes.

This raises the question as to what is already known about digital onboarding in higher education institutions and how it is carried out? Further, what purpose follows digital onboarding interventions in higher education institutions and what outcomes do they achieve? An extensive overview of the scientific literature needs to be gathered to answer the raised questions.

To investigate and map the extensive literature, we selected a scoping review approach [13]. Our article adopts Klein and Polin's [14] definition of onboarding as "formal and informal practices, programs, and policies enacted or engaged in by an organization or its agents to facilitate newcomer adjustment" (p. 268). This definition combines a multitude of possible actions that can be taken to incorporate new members into the higher education institution. The literature recognizes the term "onboarding" as one of the new words for a construct [8] that has also been termed "orientation" [15], "socialization" [6], and "newcomer adjustment" [16]. Furthermore, we focus on the onboarding of first-year students, as the time period of the first year seems to be especially noteworthy for incoming students [3,4].

A preliminary search for all types of existing reviews on this specific topic was conducted in SCOPUS and PsycArticles on 20 December 2021. The search identified no types of reviews targeting the questions or topic of this scoping review. Both of these databases were chosen because they focus on psychological literature or include an extensive list of psychological articles [17,18]. Gusenbauer and Haddaway [19] also identified these two databases as useful resources for literature reviews. In conclusion, this review has the objective to report on and map interventions which are used in digital onboarding of first-year students in higher education institutions. The review investigates what interventions are used for what purpose in the digital onboarding of first-year students and what reported outcomes of this interventions are. Additionally, this review examines if and how the digital onboarding settings differ from each other.

Research Questions

1. Primary Question:

What interventions are currently used for the digital onboarding of first-year students in higher education institutions?

2. Secondary Questions:

What are the purposes of the different interventions used for the digital onboarding of first-year students?

What outcomes have been reported for the different interventions in digital onboarding of first-year students?

Do various digital onboarding settings differ from each other? If so, how do they differ?

2. Materials and Methods

As previously mentioned, scoping reviews are an effective tool to summarize a large quantity of evidence into a single study [13]. The systematic collection of this evidence

mandates the application of a rigorous methodological procedure. For this reason, in conducting this review, we followed the guidelines of the JBI Manual for Evidence Synthesis [20], which draws upon the methodological framework of Arksey and O'Malley [21]. Specifically, Aromataris and Munn [20] presented an overarching structure in line with the PRISMA-ScR Extension for Scoping Reviews [22], including the following sections: introduction, methods, results, discussion, and conclusion. These sections can be adjusted to the needs of the individual scoping review and can also be further subdivided into subsections. For example, an adjustment in the current article entails listing the eligibility criteria in the method section instead of after the introduction. We made this choice in the interest of enhancing readability and logical flow of thought.

2.1. Eligibility Criteria

Our chosen eligibility criteria defined the necessary characteristics of an article or other source of evidence (SOE) to be included in this scoping review [20]. The following criteria were selected based on the current study's research questions.

2.1.1. Types of Participants (Population)

We included studies with participants who were freshmen university students or first-year students at all possible kinds of universities. Any characteristics of these students other than being in their first year were not relevant to this scoping review.

2.1.2. Concept

The main purpose of this study was to investigate which interventions are currently used in digital onboarding settings for first-year higher education students. Expected types of interventions included micro-interventions, wise-interventions, diary tasks, self-help interventions, interventions for the transmission of information, and interventions to foster interaction between students [23,24]. We also investigated the purposes and outcomes of these interventions in digital onboarding settings.

2.1.3. Context

We included only studies that were concerned with digital or virtual settings of onboarding in higher education. Higher education was further defined as entry-level study programs in universities, colleges, or other tertiary educational institutions. We excluded studies that investigated onboarding in a non-digital or non-virtual setting or in a setting outside of higher education. Exceptions to this rule included the onboarding of foreign students to a university as part of an exchange program or semester abroad program.

2.1.4. Sources of Evidence

For this scoping review, we included all types of SOEs because of the limited range of literature available on this topic. Examples included quantitative studies, qualitative studies, mixed-method studies, and grey literature. The type of SOE was left open, as the research topic, in combination with the research question, called for a wide range of information. Furthermore, the research topic could represent multiple research areas, including psychology, education sciences, and business [5,9]. We excluded SOEs that solely concerned the technical implementation of digital onboarding with first-year university students due to our focus on identifying and mapping the literature on interventions in onboarding of first-year students. Lastly, we imposed no language restriction for the included SOEs.

2.2. Search Strategy

The first step of our search process entailed conducting a manual search in the institutional library and on Google Scholar to obtain an overview of existing terms related to the research topic. Next, we performed a preliminary search in SCOPUS and PsycArticles to identify the necessary search string. Identified words for the search string

were: “onboarding,” “virtual onboarding,” “digital onboarding,” “newcomer adjustment,” “undergraduate adjustment,” “newcomer socialization,” “undergraduate socialization,” “digital orientation,” “virtual orientation,” “student*,” “freshmen,” “first year,” “beginner,” “starter,” “undergraduate,” “newcomer,” “rookie,” “universit*,” “colleg*,” “higher education,” and “tertiary education.” We decided not to restrict the search for SOEs to a specific time period, as the SOEs were limited, and we did not want to miss relevant SOEs. We then used the final search string to identify resources in four databases: SCOPUS, Web of Science, BASE, and PsycInfo. The search strings for all four databases can be found in Appendix A. In the fourth step, we conducted a manual search in the reference lists of the articles that were chosen for inclusion in the analysis of this scoping review.

2.3. Sources of Evidence Selection

We divided the process of selecting SOEs in this scoping review into multiple parts. All steps of the SOE selection were carried out in an iterative process between two of the three authors of this scoping review. The third researcher was only contacted in case of a disagreement between the first two authors. Deciding on the final search string, manual searches for additional SOEs, removing duplicates, title and abstract examination, full-text extraction, as well as choosing the final included SOEs were performed by the two researchers independently and then agreed upon in research meetings. Following the eligibility criteria, 317 SOEs were identified through database searches and 15 SOEs through further manual searches. After the removal of duplicates, 233 unique SOEs remained. The titles and abstracts of these 233 SOEs were screened according to the inclusion and exclusion criteria, which left 29 SOEs for the final full-text examination. All 233 titles and abstracts were double-coded by two researchers, with inter-coder reliability of $\kappa = 0.716$, which fell within the range ($0.61 \leq \kappa \leq 0.80$) that Landis and Koch [25] defined as substantial agreement between the raters. Full-text examination was also performed according to the inclusion and exclusion criteria of this scoping review, which resulted in selecting 17 SOEs for the review. Figure 1 presents a flow chart illustrating the entire process of SOE selection, which was rebuilt and customized following Peters et al. [26]. Microsoft Excel outputs were used to manage the results of the searches.

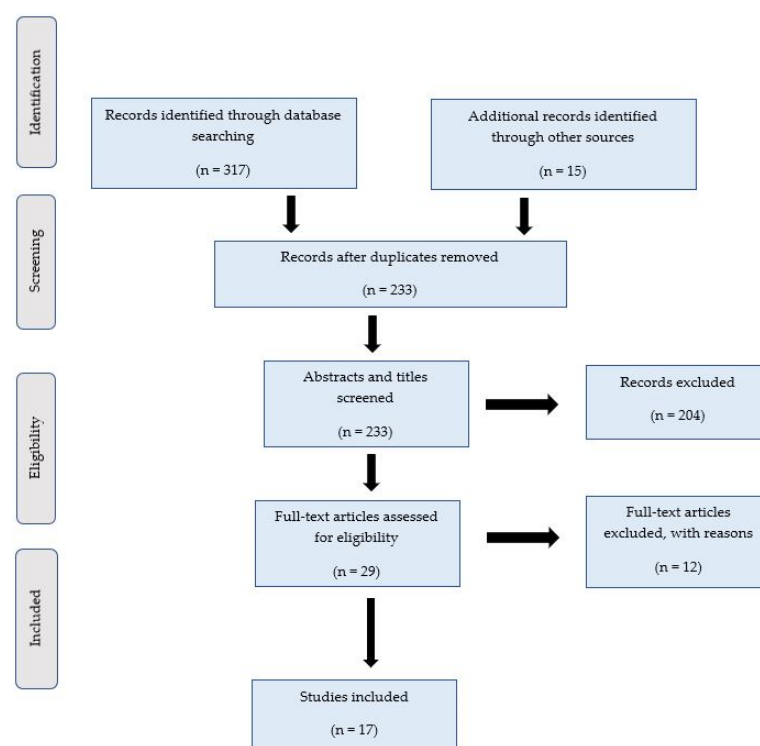


Figure 1. Scoping Review Flowchart After Duplicates Were Removed.

2.4. Data Extraction/Analysis and Presentation of Evidence

In this scoping review, the data extraction or data charting was carried out via a data charting table in Microsoft Excel. This table contained identical information as the later mentioned table of results. Because synthesizing the extracted data from the SOEs would not be considered appropriate for a scoping review [20], we did not include such a procedure in our investigation. Two members of the research team charted the data following Arksey and O'Malley's [21] narrative review technique and then descriptively mapped and categorized the results in a table based on frequency counts. The third researcher was consulted if there were disagreements in the process of the data charting between the other two researchers. We made an exception to frequency counts for articles that used a preliminary categorization for an intervention type; in such cases, we adopted the stated category of intervention for our review. The following section presents the results of our review in the form of a table containing the following information: authors, year of publication, title, SOE, intervention, purpose of intervention, outcome investigated (if present), setting of onboarding, and future research directions.

3. Results

This section presents a summary and analysis of the results of the data extraction from the included SOEs, following the structure of the previously mentioned research questions that guided the current study. All of the results were drawn from 17 SOEs that addressed digital or virtual onboarding as well as onboarding interventions for higher education students. Notably, none of these SOEs specified how the authors defined an onboarding intervention as digital or virtual. For that reason, we adopted the SOE authors' own usage of the terms digital or virtual to their onboarding interventions in order to accurately describe each onboarding intervention. Table 1 displays the charted data from the SOE that were included in the final analysis.

3.1. Purpose of Interventions

In this scoping review, in 16 of the SOEs we examined, either the SOE specified the purpose undergirding the intervention, or the authors' aim could be extracted through careful reading of the SOE. While these studies presented various reasons for implementing digital onboarding interventions, the following were named in most of the reports: presenting important information [27,34], community building [29,32], and reducing uncertainty in students [37,39].

Most of the SOEs discussed informing incoming students about relevant institutions, help services, and resources available to them (e.g., [34]) as a crucial purpose of the intervention. For instance, Bynum [27] described the interventions related to the IT help desk as aiming to inform students about the support they could expect from the practices and resources the IT help desk offered. In the same vein, Paul et al. [41] mentioned that their intervention, which comprised a multimedia online learning module for a library orientation, was intended to provide critical information and needed resources to the incoming engineering students. In addition, Januszak and Koorie [33] made similar assertions.

Community building and networking between incoming students were reported by three SOEs as forming the purpose of their interventions [29,31,32]. Specifically, Motycki and Murphy [31] mentioned that their interventions should help incoming students develop connections with each other and meet other new or experienced students.

Uncertainty was another factor targeted by interventions for digital and virtual onboarding. The Hochschule Coburg [38] described the goal of using their onboarding interventions to help incoming students choose the right study program from the beginning, while Fullick et al. [37] and Lucke [39] wanted to reduce students' uncertainty on campus and in the new environment. However, some researchers stated that uncertainty could also be reduced by giving students an intervention that would allow them to receive a better physical orientation on the campus (e.g., [12,35]).

Table 1. Charted Data.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Bynum [27]	Digital Orientation for New Students: Hiding the Tech Behind the Fun ...	Conference paper	IT Intro webpage: links, facts, and orientation regarding IT services; international student IT session: configuration and connection of devices; Moodle scavenger hunt: interactive game via digital maps; student-run dorm sweeps: in-person help with configuration and connection of devices	Provide information critical to getting connected to campus resources, show students where and how to get help, and offset the Week 1 helpdesk rush	IT visibility and help improved for students	Digital settings	/
Heinz and Fischer [28]	Onboarding by Gamification. Design and Evaluation of an Online Service to Support First Year Students	Conference paper	Eight stages in onboarding, each with three to five educational game units; four per semester, which were activated monthly; topics were based on study program; gamification of onboarding	gOPAL wanted to contribute to the success of studies in the onboarding phase	gOPAL was attractive to the users in terms of pragmatic quality and hedonic quality; students were motivated to use a voluntary, gamified online support service in the onboarding phase of their studies	gOPAL; online service embedded in learning management system; virtual environment	/
Löw et al. [29]	Grätzelbot: Social Companion Technology for Community Building Among University Freshmen	Conference paper	Chatbot scavenger hunt	Network building, getting to know the university, collecting knowledge and best practice examples	Students got to know the university campus; network building was stimulated	Virtual environment (Discord); virtual companion	Future research should refine network building properties and focus on the transition between onboarding and everyday life
Carpenter [30]	Transitioning a Marquee Orientation and Transition Program for Increased New Student Engagement and Retention Amidst the COVID-19 Pandemic	Journal article	Digital registration days (obtaining a student ID and first-semester course schedule); 12 brief emails sent with pictures and videos about the people working in essential services; social media postings about virtual and digital events (Instagram); virtual office trivia; virtual pet photo competition; streamed haunted campus tours; biweekly virtual check-ins with families to answer questions about transition to university; academic advisors reach out to newcomer students after online course scheduling	Onboarding of incoming students in university settings and keeping retention focus of 2019	/	Digital and virtual settings	/

Table 1. Cont.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Motycki and Murphy [31]	Bridging Systems, Building a Coalition, and Centering Students: A Collaborative Multi-Campus Approach to Orientation in the Time of COVID-19	Journal article	Livestream university welcome; virtual small-group meetings facilitated by orientation leader, complete a campus or college-specific Canvas course, one-on-one meeting with academic advisor; virtual registration labs, online task lists; interactive musical theater; introduction to classroom environment (in-person, remote, and mixed-mode); virtual campus tours	Helping new students meet each other and develop connections	Registration labs were not well visited; student were zoomed out,” and social events were rarely better visited	Digital and virtual settings; virtual orientation program; Canvas; Starfish	/
Löw and Moshuber [32]	Grätzelbot—Gamifying Onboarding to Support Community-Building Among University Freshmen	Conference paper	12-day chatbot-based onboarding scavenger hunt	Network building; getting to know the university; collecting knowledge and best practice examples	Students felt more familiar with the faculty building and the university campus after the scavenger hunt, also met other students, made new friends, and, by participating, their sense of belonging to the student community became stronger	Virtual environment (Discord); virtual companion	Explore the roles a chatbot can fill in the context of fostering social relatedness among university students
Januszak and Koorie [33]	Designing and Deploying a Virtual IT Services Orientation for First-Year Undergraduate Students in Moodle	Conference paper	Quizzes; video tutorials; practice assignments; mandatory use of chat function	Provide students with the information on how and where to ask for help with library or technology questions, how to download and access software required for courses, how to access library resources, how and where to print, how to connect to the secure Wi-Fi network, and how to identify phishing scams.	Many students were reached by the onboarding intervention	Virtual gamified environment in Moodle	The onboarding intervention should include panoramic tours in the future; more focus groups should be conducted to evaluate the intervention

Table 1. Cont.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Prior et al. [34]	Realizing the Full Potential of Orientation as a Process: Practitioner Perspectives on One University's Pandemic Response for Orientation Efforts	Journal article	Pre-orientation modules: information about university systems, student services, etc. (live or pre-recorded); live virtual events: students and guests received resources and an overview of academic essentials based on their college and major (also getting to know other students and orientation leader), including personalized orientation schedules; required orientation leader sessions; academic advisor sessions; virtual social activities; Q&A sessions; post-orientation modules hosted in the learning management system: information from the Dean of Students, Division of Diversity and Inclusion, etc.; quizzes; digital guest and family meetings (e.g., "What I Wish My Family Knew")	Students get to know the university system and the university itself, creating a sense of belonging and connection in students	/	Digital and virtual settings via Microsoft Teams	Pre-orientation modules should be more engaging; social media needs to be implemented more effectively; check-out process for live sessions to identify direct outcomes, etc.; more direct outreach to family members from the university
Golubski [5]	Virtually Onboarding and Supporting Adult Students in College Using Web 2.0 Technologies	Book chapter	Digital student support service (interactive options via messaging, video conferencing, and digital document sharing; nontraditional working hours, e.g., in the evening); social network sites such as Facebook, Instagram could be used for social connections and digital events via RSVPs; Instant Messaging via Yahoo Messenger or Microsoft Messenger; Skype for digital video-based telecommunication or digital advisor sessions; Google Groups for collaborative communication between group members (discussion board) or storing of shared projects; Twitter (advisors could, for example, send out tweets with deadlines, announcements)	Strategies for onboarding of incoming adult and distant-based higher education students	/	WEB 2.0 Technologies; virtual and digital settings	/

Table 1. Cont.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Tüzün and Özdiñ [35]	The Effects of 3D Multi-User Virtual Environments on Freshmen University Students' Conceptual and Spatial Learning and Presence in Departmental Orientation	Journal article	Virtual orientation environment design started from the building gate and included classrooms, laboratories, and faculty offices. The design aimed to enable the users to navigate in the environment.	Determine the practicality of using Active Worlds and similar 3D MUVes for freshman orientation	Conceptual Knowledge Test: both groups increased significantly but no significant difference; spatial knowledge inventory: partially better in digital environment; orientation evaluation: regarding usefulness and enjoyment, no significant differences emerged between the two groups, both of which said they had fun during the experience; presence questionnaire in virtual environments	Virtual setting; open world game; virtual open world environment	Future studies might involve freshmen from multiple departments or entire school to address this limitation; researchers need to examine users' movements in Z-axis and examine the influence of their spatial experiences on multiple floors; this study did not include the use of audio elements in the virtual environment, and future studies should examine the influence of these elements on orientation; this study did not use the affordance of collaboration, and future studies can make use of this affordance in virtual orientation environments for ice-breaking and socialization activities and examine its effects; future researchers can move further into the wilderness and reveal the settlement potential of 3D MUVes for orientation purposes

Table 1. Cont.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Henning [12]	Student Onboarding with Augmented Reality	Book chapter	The STOBAR project—Student Onboarding Using Augmented Reality—was intended to open the way to increased community building during the orientation phase of students. It made use of the students’ smartphones mentioned at the beginning of this article. This is not primarily because mobile learning is essential but, as explained, because of the connection between the learning performance of the students to be achieved during onboarding and their existing reality of life. STOBAR was thus intended to help students find their way around a university for the first time and to establish contact with fellow students. It was intended as a supplement to the “traditional” orientation events.	In this context, linking a geoinformation system with administrative systems can offer significant incentives. With the help of mobile devices, campus exploration is not only knowledge acquisition but also fun.	/	Virtual setting; augmented reality for mobile devices	Potential for application in other contexts that involve learning complex geographic relationships with other data; potential for application in tourism, for example, in city tours; potential for community building with mobile devices; potential for friendship building through interaction in virtual setting

Table 1. Cont.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Hughes et al. [36]	Preserving Engagement: Orientation Amidst a Global Pandemic	Journal article	Student small groups and “Ask the Experts” panel discussion; academic advising, course registration labs, “Ignite Your ‘Nole Experience”; First-year Fridays and family webinars	/	86% of respondents indicated an improvement from the FSU experience, 88% felt it helped reinforce resources from online modules, 70% more easily created social connections; in 2019, academic advising satisfaction was at 78%; in 2020, it increased to 87%; in general, New Student & Family Programs received fewer complaints about being too rushed or incomprehensible; 41% of students appreciated their academic advising experience; virtual course registration labs proved invaluable. 86% felt better about course registration. Through these program offerings, 578 students became engaged and were helped to connect to communities and resources. 99% rated their Ignite session positively, and 94% understood better how to get connected. 92% felt better connected; 2559 family members in total engaged with the Family Webinar series throughout the summer.	Digital and virtual settings	/

Table 1. Cont.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Fullick et al. [37]	Mentor and Protégé Goal Orientations as Predictors of Newcomer Stress	Journal article	Peer mentoring to reduce stress via 15-min video-conferencing or digital chat	Influence cognitive sense-making; hopes that first-year students would benefit from positive outcomes when academic socialization programs (e.g., mentoring) were used to provide information, reduce uncertainty, and promote learning. Provide orientation programs that foster student participation, feedback seeking, and discovery	Stress reduction: protégés were also asked to report their level of mentor-related stress reduction upon completion of the third mentoring session; stress (three-item measure extracted from House and Rizzo's (1972) anxiety-stress questionnaire); results from this study indicated that first-year students who received greater career support from their mentors reported greater stress reduction than did those who received less career support; in the present study, however, psychosocial support received also had a uniquely positive relationship with stress reduction; mentors played a significant role	Digital setting	Future research should examine the possibility that protégé and mentor levels of avoid goal orientation may also have very different effects on different types of outcomes
Hochschule Coburg [38]	ONE ODE—Students, Teachers and Service Departments Cooperate for the Benefit of International Prospective Students in the STEM Subjects. Your Desire to Study. Our Support Offer. Your Study Decision.	Informational flyer	Online counseling (live/video/chat, expert/video/telephone, and video/conferencing); peer-to-peer materials; group chat; orientation test; atmospheric contact; transition to existing services	A sure sense of the demands of the intended field of study, peer-to-peer study atmosphere, and one's own possible course of study. The goal was a well-considered study decision and successful study progress from the first minute onward. Especially for students from abroad	/	Digital and virtual setting	/

Table 1. Cont.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Lucke [39]	Design eines pervasiven Lernspiels für Studienanfänger (Design of a pervasive learning game for first-year students)	Conference paper	Pervasive learning game; virtual card-game	A learning game can help defuse (difficulty and uncertainty at the beginning of studies) this situation by introducing first-year students to relevant information, places, and processes immediately in the new environment in an intuitive way.	Since students preferred their own devices, which were mainly small or had large displays, various platforms to support the use interface were necessary. Therefore, a hybrid strategy was helpful. All students were familiar with mobile devices and thus with computer games as well, even if some who were less experienced needed assistance. Fun, sporty but also serious aspects should be included to ensure the attractiveness of the game as much as diversity of personal; the majority of students were asking for a team game that was mobile across campus and city area; it should focus on enrollment in courses, academic advising/examination office, subject-related and social assistance. Rally and adventure games seemed promising but complex to implement. Card games with fun and sporty elements were also rated very highly.	Virtual setting	/
Berkling [40]	Connecting Peer Reviews With Students' Motivation Onboarding, Motivation and Blended Learning	Conference paper	Peer reviewing and grading in a virtual setting via a student-chosen platform	The gamified version of the course, builds on mastery and autonomy	Mostly happy with the course and its format; The hypothesis when evaluating the survey was that most learner types would feel comfortable with the course because the course was designed to meet several learner-type needs	Virtual setting	Virtual setting; blended and open learning environment

Table 1. Cont.

Authors	Title	Source of Evidence	Intervention Type	Purpose of Intervention	Outcomes Investigated (If Present)	Setting of Onboarding	Future Research Directions
Paul et al. [41]	Board 77: Designing, Launching and Assessing a Multimedia Online Learning Module for Library Orientation of First Year Engineering Students	Conference paper	Online learning course for a library using videos and audios; welcome to Dibner Library (a filmed welcoming video featuring the instructional librarian); access and services (library space, hours, where students could go and what they could do within the library system); learning and events, which highlighted the weekly engagement activities and the semester schedule of library workshops.	A collaboration between the Dibner Library and Faculty Innovations in Teaching and Learning (FITL) produced a multimodal asynchronous module to provide incoming students an online library orientation. The authors felt that an independent technology-driven approach would be ideal for engineering students who would be engaging with and employing such an approach in their coursework and probably in their career; The video development objective from the beginning of this project was to create products that were informative, visually stimulating, and, most importantly, short in length to increase viewership.	736 students viewed the module in the fall of 2018. The first question was, “Which information did you find most useful?” 68.9%, chose “All three of the videos were equally useful.” Of those who expressed a preference, 13.1%, chose the Library Services Video (Accessing Bern Dibner Library was second at 9.5%, and Dibner Library space was last at 8.7%) The second question was “Which Topic area do you need more information on and when?” In this case a small number, 6.8%, chose “This information isn’t useful to me.” The largest number chose “All three topic areas—During the semester” The second largest, 17.8%, chose “Library Services—During the Semester”	Digital and virtual setting	Opportunities exist to obtain more comprehensive assessment data using the Learning Management System. The Authors can tag students by cohorts, creating semester groupings of the students, and the authors can examine data by majors. Employing Gradebook, a feature of the LMS, would facilitate retrieval of assessment data. The gradebook would allow the authors to keep track of task completion in the module. If the authors create quizzes and scoring cards, the authors could see user activity and grade it. plan to take advantage of all these features in updates to the module

Lastly, some interventions aimed to increase student retention rates [30] or boost the overall success [28] of incoming students in their study program. All of the extracted intervention purposes from the included SOEs are available in Table 1.

3.2. Onboarding Interventions

“Action taken to improve or help a situation” is the definition of an intervention [42] (p. 1). Thus, onboarding interventions represent actions that improve the situation of the incoming students. The SOE in this scoping review described a multitude of onboarding interventions which left the research team with the opportunity to not only map and collect all the digital and virtual onboarding interventions but also to find a suitable way to categorize these interventions. Although two possible schemes involved categorizing by (a) their specificity [43] or (b) their complexity [44], we ultimately decided to employ a newly developed category, of (c) intervention dimensions, in order to provide onboarding experts in higher education and future researchers a categorization scheme that would reflect the purposes and outcomes of onboarding interventions mentioned in the SOEs reviewed in this paper.

- (A): As Table 1 reveals, the interventions ranged from specific target areas, such as the library [41] or student services [34], to broader interventions that could be applied to the whole campus, such as chatbot scavenger hunts across the campus [29,32]. In comparison to studies focused on specific target areas, the broader types of interventions predominated and were applicable to a wider range of settings in digital and virtual onboarding.
- (B): Besides the differences in the targeted areas of these interventions, they also can differ in their complexity. Examples of complex onboarding interventions included programs that were difficult to develop, time-consuming for the higher education institution to apply, or cost-intensive. While some interventions used relatively simple designs, such as social media posts, to publicize events and easily connect with students [5], others involved virtual environments that allowed students to roam and explore the surroundings of the college or university [12]. Such onboarding interventions as Henning’s [12] virtual environment are difficult and time-consuming to build, which complicates their implementation for higher education onboarding. Consequently, less complex onboarding interventions prevailed in the available SOEs and were mentioned more often.
- (C): Ultimately, categorizing the digital and virtual onboarding interventions of this scoping review into dimensions that reflected the authors’ purposes and study outcomes as described in the SOEs seemed the best course to arrive at the most useful results. Therefore, we developed this categorization scheme by scanning the SOEs for similarities in the onboarding interventions they described. Among the SOEs reviewed, the authors mentioned the purpose of their onboarding interventions or the outcomes they observed or both purpose and outcome, as presented in Table 1. Identifying the similarities in purposes and outcomes allowed us to distinguish four main dimensions that were common to all of the onboarding interventions in varying degrees. Specifically, these four dimensions were either directly mentioned in the SOE as a purpose or an outcome of the intervention; alternatively, a onboarding intervention could be sorted into one of the four dimensions via thematic resemblance. The identified dimensions, which we called intervention dimensions, were then used to categorize the onboarding interventions.

The four intervention dimensions are information interventions, socialization interventions, counseling interventions and self-study interventions. An onboarding intervention was sorted to the information intervention dimension when the SOE described presenting information about the university or college to incoming first-year students. An onboarding intervention was sorted to the socialization intervention dimension if the SOE described that the interaction between incoming students or between incoming students and academic staff was fostered. If an onboarding intervention was sorted to the counseling

intervention dimension, then the SOE had to describe an intervention that went beyond pure information transmission to help students resolve problems and issues through interaction between incoming students and academic staff or between incoming students and older students. An onboarding intervention was sorted to the self-study intervention dimension if the SOE described students' actions extending beyond the scope of the onboarding process. For example, one study incorporated online task lists [31] that were used even after the onboarding process concluded. Some interventions fit more strongly in one of the mentioned intervention dimensions, while others were multidimensional. Nevertheless, we found it possible to categorize all of the interventions into one of the four intervention dimensions. Table 2 visualizes these extracted interventions and their assigned intervention dimension.

Table 2. Dimensions of Interventions.

Intervention	Information Interventions	Socialization Interventions	Counseling Interventions	Self-Study Interventions
IT intro webpage [27]	X			
International student IT sessions [27]	X			
Moodle-scavenger hunt [27]	X	X		
Chatbot-scavenger hunt [32]	X	X		
Educational games [28]	X			
Student-run dorm sweeps [27]	X	X		
Digital registration days [30]	X	X		
Virtual office trivia [30]	X	X		
Social media postings and events [30]	X	X		
Information emails [30]	X			
Virtual pet photo competition [30]		X		
Streamed haunted campus tours [30]	X	X		
Biweekly family check-ins [30]	X		X	
Digital academic advisor sessions [30,34,36]			X	
Live-streamed university welcome [31]	X			
Virtual small-group meetings [31,36]	X	X	X	
Orientation leader sessions [31,34]	X	X	X	
Campus or college-specific canvas course [31]	X			

Table 2. Cont.

Intervention	Information Interventions	Socialization Interventions	Counseling Interventions	Self-Study Interventions
Virtual registration labs [31]	X			
Online-task lists [31]	X			X
Interactive musical theater [31]		X		
Introductions to classroom environments [31]	X			
Virtual campus tours [31]	X	X		
Quizzes [33]	X	X		
IT video tutorials [33]	X			
IT practice assignments [33]	X			
Digital chat interactions [33]		X		
Pre-orientation modules [34]	X		X	
Live virtual events [34]	X	X		
Q&A sessions [34]	X			
Post-orientation modules [34]	X			
Parents and friends meetings, webinars and Q&A sessions [34,36]	X		X	
Digital student support services [5]	X	X	X	
Messaging via instant messengers [5]		X		
Video-based telecommunication sessions [5]	X	X	X	
Discussion boards [5]		X		X
Shared workspaces [5]	X	X		X
Virtual orientation environments [35]	X			
Augmented reality for orientation environment [12]	X	X		
Peer mentoring [37]	X	X	X	
Online counseling [38]			X	X
Orientation tests [38]				X
Digital group chats [38]		X		
Atmospheric contact [38]		X		

Table 2. *Cont.*

Intervention	Information Interventions	Socialization Interventions	Counseling Interventions	Self-Study Interventions
Pervasive learning games [39]	X	X		
Peer reviewing and grading [40]		X		X
Online library course [41]	X			
Learning events [41]	X	X		
Library workshops [41]	X			

The following results emerged from the categorization of the interventions into intervention dimensions: from the 49 onboarding interventions, 38 interventions were identified as information interventions, 27 as socialization interventions, 10 as counseling interventions, and six as self-study interventions. As mentioned, some interventions fit into multiple intervention dimensions, leaving only 15 interventions uniquely in information interventions, six in socialization interventions, and one each in the counseling and self-study intervention dimensions. The remaining 58 interventions fit into at least two intervention dimension categories, with information interventions predominating.

According to these results, information interventions represented the prevalent intervention dimension in onboarding of first-year higher education students. Thus, the goal of conveying information to incoming students emerged from our review of the pertinent SOEs and according to our custom-built categorization scheme as the number one purpose and outcome in this context. The socialization of incoming students represented the second major goal of onboarding interventions, with the second highest number of interventions fitting the socialization dimension.

An interesting result is that most of the socialization interventions (19 out of 27) also fit into the intervention dimension of information, further confirming information interventions as the most common onboarding interventions in the digital onboarding of first-year higher education students. The following section presents an overview of the categories of intervention dimensions, as mapped in Table 2.

3.2.1. Information Interventions

Information interventions primarily focused on presenting information about the university or college to incoming higher education students. These types of interventions were diverse and included webpages [27], virtual events [30], welcoming events [31], virtual campus tours [30], orientation leader sessions [34], or educational games [28].

Common forms of digital or virtual information interventions for the transmission of new information around universities and colleges were online info webpages, such as an IT intro webpage [27]. They are used to explain basic information to incoming students (e.g., how to install or use specific software).

Another form of basic information transmission interventions involved virtual events before the beginning of the term. Such events provided explanations, for example, how to register for particular higher education programs [30], or welcomed students to the institutions or facilities [31]. These events could be hosted via common Web 2.0 applications, such as Zoom, Skype, or other video-based software programs and were described as forming the backbone of modern digital or virtual onboarding practices [5].

Campus tours were also common interventions at many universities. Especially during the pandemic, such activities could be transformed into digital or virtual tours [30]. These virtual environments were built to allow students to explore campuses on their own terms and from their own homes via their own mobile devices. The tours often used mobile applications and virtual reality [12] or 3D multi-user environments [35].

Many of the interventions that were mentioned as part of the dimension of information interventions could also be identified as socialization interventions, such as virtual campus tours [35] or orientation leader sessions [31,34]. The following explores this crossover in more detail.

Combination of Information and Socialization Interventions

As mentioned earlier, the information interventions focused mainly on the transmission of information. That said, some of the interventions in this dimension went beyond purely transmitting information and added socialization elements. Examples of these interventions included orientation leaders [31,34], digital help services [27,33], academic advisor sessions [30,34], introductions to the new classroom environments [31], and educational games [28]. Furthermore, orientation leaders could be added to digital and virtual campus tours [31,34]. Campus tours were primarily intended to transmit information about buildings and relevant facilities [30]; in contrast, campus tours with orientation leaders [31,34] also fostered engagement between incoming students and facilitated counseling by the orientation leader. Such an enhanced campus tour made this intervention a socialization and counseling intervention because orientation leaders interacted with the incoming students and supported these students in their first steps at university or college [31,34].

Digital or virtual institutional help services were another form of intervention that entailed more than simply the transmission of information; in addition, the inclusion of these services in digital versions of higher education onboarding has been growing. For example, Bynum [27] described the use of a digital version of an IT help service desk, which also offered digital help sessions for incoming international students. Even as presenting students with relevant information concerning IT services acquainted them with the IT offerings of their higher education institutions, the digital help sessions also engaged incoming students in interacting with other incoming students as well as their institution's IT help services. Januszak and Koorie [33] also supported incoming students with IT services, along with quizzes, video tutorials, and the use of practice assignments that encouraged the socialization of incoming students.

In addition to introducing IT services, initial contact with academic advisors and student services can also be implemented in the form of digital or virtual onboarding. Prior et al. [34] discussed using Microsoft Teams for access to student services; meanwhile, Carpenter [30] described how academic advisors reached out to students after course scheduling. In this intervention, information can be transmitted to students and academic advisors can be met through interaction between incoming students and academic advisors. Furthermore, "Ask the Expert" panels [36] or introducing new classroom environments [31] could easily be done digitally or virtually to engage a large number of students in conveying onboarding information and promote socialization between these students.

Other ways to innovatively engage incoming students with information were educational games, which had the added advantage of lasting beyond the first days or weeks of onboarding students, thus leading them through the first semesters of university or college [28]. These games were described as a great way to teach incoming students information in a gamified way that allowed the students to have fun while learning. Furthermore, educational games were shown to help incoming students get to know each other by providing easy talking points. In addition to educational games, researchers used other approaches in digital or virtual onboarding to convey information over a longer period of time. For example, Prior et al. [34] described digital and virtual pre- and post-orientation modules that allowed students to gather information and interact with each other both before and after formal onboarding practices.

3.2.2. Socialization Interventions

The dimension of socialization interventions contained interventions that promoted new students' interactions with fellow newcomers and academic staff or gave incoming students the chance to connect with other people at their college or university. Common

forms of interventions in the socialization dimension transformed face-to-face interactions into the digital or virtual space. Digital chat interactions, messaging via instant messengers, video-based telecommunication sessions, atmospheric contact, or digital group chats were all represented among the different synonyms for communication over Web 2.0 technologies [5,38] and have increasingly become standard in digital or virtual onboarding of higher education students.

Several authors mentioned the use of scavenger hunts to onboard incoming students. For example, Löw et al. [29] used the virtual companion “Grätzelbot” to create a scavenger hunt as an interactive way to onboard incoming students over the WEB 2.0 platform Discord. Students were able to complete the scavenger hunt in 12 days; while experiencing a virtual platform with a large amount of information, they were also able to connect and interact with other students, increasing the likelihood of community building [32]. Bynum [27] also employed a scavenger hunt to onboard students in an interactive way using the software Moodle (created by Martin Dougiamas).

Live events, originally designed to help students interact with other students and find new friends, could also be conveyed into a digital or virtual setting. Examples of such socialization events included virtual office trivia [30], virtual pet photo competitions [30], interactive musical theaters [31], or other live virtual events [34]. Virtual small-group meetings [31] and learning events [41] were also implemented to further contribute to the socialization of incoming students. These activities began by facilitating incoming students’ engagement with other students and went on to enrich the digital and virtual exchange between formal learning situations.

3.2.3. Counseling Interventions

The counseling intervention dimension featured interventions that supported the interaction between incoming students and faculty staff while also helping incoming students with problems and issues that might arise during their first weeks or months at their university or college. As already mentioned in the discussion of the information intervention dimension, digital academic advisor sessions [30] and digital student support services [5] were also typical counseling interventions. These two forms of interventions aimed to minimize and solve problems from incoming students through participative exchange between the students and faculty staff. Other forms of participative consultive exchange took place between incoming students and older, more experienced students via peer-to-peer mentoring [37] or online counseling involving trained professionals [38].

Counseling interventions focused on both incoming students and their families have also been increasing in digital and virtual onboarding. Carpenter [30] described biweekly family check-ins in which parents could ask their questions concerning their children’s transition from school to higher education institutions. This whole-family approach to digital and virtual onboarding was able to reduce fears in the parents of first-year college and university students. Along similar lines, Hughes et al. [36] and Prior et al. [34] welcomed intervention practices that included families and other guests in addition to incoming students. Zoom (created by Eric Yuan, San Jose, CA, USA) and other WEB 2.0 technologies have enabled universities or colleges to offer this form of counseling interventions.

3.2.4. Self-Study Interventions

The dimension of self-study interventions comprised interventions aiming to stimulate incoming students to actively work on their study programs. Classic onboarding interventions that were easily translated into the digital and virtual space included task lists [31] and shared workspaces [5]. In particular, shared workspaces (e.g., Google Docs) allowed incoming students to exchange their materials with other students and enriched the learning culture.

Higher education institutions typically administer orientation tests to incoming students at an early stage of higher education. Such tests can guide students in their search for the right study program [38]. Orientation tests were described as part of digital and

virtual onboarding of higher education students as a way to test students' will to study and help them choose an appropriate study program. In addition to the previously mentioned interventions in this dimension, digital or virtual discussion boards [5], peer-review, and grading [40] were all described as essential self-study interventions that could help incoming students reflect on their study load, study achievements, and study goals.

3.3. Settings of Onboarding

As with our scrutiny of the onboarding interventions, we scanned the SOEs for similarities and differences in terms of onboarding settings. All of the SOEs either mentioned how their onboarding interventions were digitally or virtually applied, or the setting could be derived from the nature of the intervention. An example of how we were able to derive the onboarding setting from the intervention is Bynum's [27] international student IT sessions. We began by noting the author's mention of a dedicated home page for the IT help, but we also worked out that he needed to employ particular telecommunication software to communicate with incoming students for his international student IT sessions.

Our evaluation of all of the onboarding settings described in the SOEs yielded five settings that could be identified as the main digital or virtual setting and therefore act as a categorization. These divisions included learning platforms, homepages, virtual environments, apps and mobile applications, and telecommunication software. A perfect example of the learning platform setting would be the interventions of Januszak and Koorie [33] who implemented their onboarding interventions on the learning platform Moodle. Some researchers used a homepage that had been specifically designed for their intervention [27,41]. Virtual environments were reflected in the 3D multi-user virtual reality reported by Tüzün and Özdiñ [35]. An intervention that was created for smartphone use or as an app fell within the setting of apps and mobile applications, as in Henning's [12] intervention which described benefits of linking smartphone use with the technology of virtual reality to help with the campus orientation of incoming students. In the last setting, the digital or virtual onboarding intervention was applied through telecommunication software, such as Zoom or Microsoft Teams. This setting included various onboarding interventions that Golubski [5] described, including instant messaging via Microsoft Teams or video-calls via Skype. However, some of digital and virtual onboarding interventions reviewed used multiple settings, as we observed in Henning's [12] intervention that featured a mobile phone through which a virtual reality environment was applied. To visualize the different interventions within the five main settings, Table 2 was revised to create Table 3.

The following results emerged from the categorization of the interventions into onboarding settings: 34 onboarding interventions could be assigned to the telecommunication software category, 23 belonged to virtual environments, 21 used learning platforms, 11 were deemed as apps and mobile applications, and eight settings were categorized as homepages. Of particular interest in these results was that most of the onboarding interventions fit into multiple onboarding settings; only 10 out of the 49 onboarding interventions featured only one onboarding setting. According to our observations, while most of the examined onboarding interventions relied on telecommunication software (34 of 49) the vast majority of the onboarding interventions used multiple digital and virtual onboarding settings. In combination with the previous results showing that information interventions were the most mentioned intervention type, it is not surprising that telecommunication software was described in so many SOEs as the predominant onboarding setting, as telecommunication software is designed for the exchange of information [5]. In contrast, apps and mobile applications were only identified in 11 out of 49 onboarding interventions, which is fascinating, considering that most modern higher education students use mobile devices [45].

Table 3. Settings of Onboarding.

Intervention	Learning Platforms	Homepage	Virtual Environments	Apps and Mobile Applications	Telecommunication Software
IT intro webpage [27]		X			
International student IT sessions [27]		X			X
Moodle-scavenger hunt [27]	X		X		
Chatbot-scavenger hunt [32]			X	X	X
Educational games [28]	X		X		
Student-run dorm sweeps [27]					X
Digital registration days [30]	X	X	X		X
Virtual office trivia [30]					X
Social media postings and events [30]					X
Information emails [30]			X		X
Virtual pet photo competition [30]			X		X
Streamed haunted campus tours [30]			X		X
Biweekly family check-ins [30]			X		X
Digital academic advisor sessions [30,34,36]			X		X
Livestreamed university welcome [31]		X			X
Virtual small-group meetings [31,36]			X		X
Orientation leader sessions [31,34]			X		X
Campus or college-specific Canvas course [31]	X				
Virtual registration labs [31]	X		X		X
Online-task lists [31]	X				
Interactive musical theater [31]			X		X
Introduction to classroom environments [31]			X		X
Virtual campus tours [31]			X		
Quizzes [33]	X		X		
IT video tutorials [33]	X		X		
IT practice assignments [33]	X		X		
Digital chat interactions [33]	X		X		
Pre-orientation modules [34]	X	X			X
Live virtual events [34]	X				X
Q&A sessions [34]	X				X

Table 3. Cont.

Intervention	Learning Platforms	Homepage	Virtual Environments	Apps and Mobile Applications	Telecommunication Software
Post-orientation modules [34]	X				
Parents and friends meetings, webinars, and Q&A sessions [34,36]	X				X
Digital student support services [5]				X	X
Messaging via instant messengers [5]				X	X
Video-based telecommunication sessions [5]				X	X
Discussion boards [5]				X	X
Shared workspaces [5]	X				X
Virtual orientation environments [35]			X		
Augmented reality for orientation environment [12]			X	X	
Peer mentoring [37]					X
Online counseling [38]				X	X
Orientation tests [38]	X				
Digital group chats [38]				X	X
Atmospheric contact [38]				X	X
Pervasive learning games [39]			X	X	
Peer-review and grading [40]	X		X	X	X
Online library course [41]	X	X			X
Learning events [41]	X	X			X
Library workshops [41]	X	X			X
Sum	21	8	23	11	34

3.4. Outcomes of Interventions

The 17 SOEs covered in this scoping review included eight conference papers, six journal articles, two book chapters, and one informational flyer. Only 12 out of the 17 included SOEs reported outcomes of their interventions. Four of the 12 did not have a method section, meaning that the authors did not report the measures, analysis methods, or methodological procedures used. In addition, seven SOEs made no mention of scales or specific items to measure outcomes. Methodology also varied widely among the included studies. Two SOEs followed a mixed-method post design without a pre-measure [29,32], while two employed a post-survey design [28,40]. One post-survey design was supported by video viewership tracking [41], another featured a longitudinal panel survey design [36], and one followed a pre-post design [37]. Lastly, one study was based on a quasi-experimental pre-post design [35].

Certain outcomes of onboarding interventions were mentioned by multiple SOEs, for example, an increase in IT visibility and IT help for incoming students were reported not only by Bynum [27] but also by Januszak and Koorie [33], who helped incoming students with quizzes, video tutorials, practice assignments, and mandatory chat-based interactions. In addition, Januszak and Koorie [33] mentioned that they measured their outcomes via the badges they awarded in the digital platform Moodle.

An increase in network building and general knowledge was achieved via the virtual scavenger hunt of Löw et al. [29]. Similar outcomes were reported by Löw and Moshuber [32], who also used a virtual scavenger hunt. Furthermore, the outcomes that they reported included that students felt more familiar with the whole campus, made new friends and learning partners, and felt an increased sense of belonging with other students. Löw et al. [29] and Löw and Moshuber [32] used online surveys and focus groups after their scavenger hunts to explore their interventions outcomes. Interestingly, Motycki and Murphy [31] remarked that the onboarding interventions involving digital registration labs and virtual social events were not well visited and that students were “zoomed out” if they attended these events. Contrariwise, students reported that they enjoyed the experience and also showed an increase in conceptual knowledge and general knowledge of their surroundings after participating in the 3D multi-user virtual environment of Tüzün and Özdiñ [35]. In that study, the authors used a quasi-experimental research design and tested their outcomes via multiple questionnaires that, for example, targeted conceptual knowledge, orientation evaluation, or demographics.

In terms of digital peer mentoring, Fullick et al. [37] concluded that if first-year higher education students received greater career support from their peer mentoring, their perceptions of stress decreased in comparison to students who did not receive as much career support from their peer mentors. Similarly, Berkling [40] described positive outcomes in a peer-review and grading course, where the learners indicated satisfaction with the course regardless of their learning style. Berkling’s [40] study design combined quantitative and qualitative survey methods, whereas Fullick et al. [37] used only quantitative measurements.

Hughes et al. [36] discussed outcomes concerning various interventions in which 88% of the students rated virtual small group sessions as helpful in reinforcing the resources from the different modules; additionally, 70% rated the experience positively for how it helped them connect with other students. Furthermore, academic satisfaction increased due to virtual and digital academic advising from 78% to 87%, while digital and virtual New Student & Family Programs saw a decrease in complaints about time management. The same New Student & Family Programs were rated by over 2559 families in a questionnaire survey design as extremely positive in terms of connecting them with other families and incoming students [36].

Other outcomes from the SOEs targeted the display sizes of pervasive learning games, as well as the games’ difficulty. Specifically, Lucke [39] demonstrated that the size of devices used in pervasive learning games affected students’ onboarding experience; interestingly, students preferred either large or small devices for playing their pervasive learning games, but medium-sized displays, such as iPads, decreased participants’ enjoyment of the experience. From that outcome, the author recommended that the interface of the pervasive learning games should be developed for all possible devices, which would allow incoming students to use their own devices. Furthermore, the researcher concluded that the difficulty of these pervasive learning games needed to be adjustable since many students had experience with gaming, in general, but not as much with learning games. The seriousness of such games should be maintained to be effective in digital or virtual onboarding, but the fun should not be neglected. Lastly, the targeted areas for this type of intervention would ideally be enrollment in courses, academic advising, or subject-related.

Lastly, the outcome of Paul et al.’s [41] online library course revealed that the participants rated all of their pre-recorded videos concerning the library as useful, with a preference for the library services video, which the authors measured through video viewership tracking. Table 1 provides a larger overview of every outcome extracted from the records in this scoping review.

In summary, the outcomes of the digital and virtual onboarding interventions in the SOEs varied widely. Interestingly, some SOE investigated one of their onboarding interventions more deeply which led these SOE to report outcomes directly linked to the purpose of their onboarding intervention. An example would be Löw et al. [29] and Löw and Moshuber [32], whose onboarding intervention had the intended purpose of increasing community building

and networking between incoming students. They also reported this as their main outcome. In comparison, other SOEs mentioned outcomes on a broader level, which did not focus directly on the intended purpose of the onboarding intervention. For instance, Lucke's [39] pervasive learning games were intended to defuse the difficulty and uncertainty of beginning a course of study, yet the outcome focused on the issues involved in creating and applying the pervasive learning game. As this discussion has shown, the different levels of detail and focus precludes comparing the outcomes of these onboarding interventions.

4. Discussion

The purpose of this scoping review was to map and categorize current interventions for digital onboarding of first-year students in higher education institutions. In multiple secondary questions, we also considered purposes and outcomes of these interventions and what settings universities and colleges used to apply these onboarding interventions. To answer these questions, we extracted information from 17 SOEs to map and categorize the various interventions. The following discussion will present interesting details of the SOEs reviewed here.

The mapping and the categorization of the examined onboarding interventions into intervention dimensions revealed that the predominant digital and virtual onboarding interventions focus on transmitting information between the higher education institutions and incoming students. This result is not surprising since information is a necessary component supporting the ability of incoming students to adapt to the new environment of higher education [46]. In return, the institutions also benefit from this information transmission in the form of adapted students who are prepared for everyday life at college or university.

The second major category of intervention dimensions entailed socialization interventions. These interventions foster contact among the incoming students, between incoming students and older students, and between the incoming students and institutional staff members. Including socialization as an important part of onboarding in higher education aligns well with the literature on student adaption [47]. Additionally, long before digital and virtual socialization interventions became a possibility, higher education institutions employed face-to-face socialization interventions to support the transition between school and tertiary education [48,49].

The dimensions of counseling interventions and self-study interventions were less frequently found in the categorization of onboarding interventions. This is interesting given that, for example, counseling has positive effects on the experience and retention of higher education students [50]. Furthermore, self-study interventions also were found to positively affect study-related variables, like better study performance [51] or peer-communication [52]. One possible explanation might be that counseling and self-study interventions are yet to be developed for digital and virtual onboarding of higher education students and therefore a goal for future research.

A key finding in the current study was that most of the identified onboarding interventions fit into more than one intervention dimension. In other words, an information intervention could also entail a socialization intervention. In practical terms, it makes sense to apply an onboarding intervention which combines the information dimension and the socialization dimension, as it allows higher education institutions to save time and costs while still achieving positive results, such as study retention or student success [53].

We based our categorization of the onboarding interventions on the purposes and outcomes of the onboarding interventions in the SOE. As a result, the findings for the secondary questions for these aspects of our investigation were similar to the previously discussed intervention dimensions. The most commonly mentioned purposes of onboarding intervention in this scoping review were presenting important information [27,34], community building [29,31,32], and reducing students' uncertainty [37,39]. These identified purposes aligned with the current literature on positive study factors, such as student adaption [46], study retention [54,55], or deep learning [56]. Besides that, the SOE which

reported outcomes directly linked to their onboarding interventions reported similar results as the mentioned purposes or the findings from the literature. For example, Löw et al. [29] and Löw and Moshuber [32] reported community building and networking between students as their main outcome. On a similar positive note, Hughes et al. [36] observed increased academic satisfaction after their onboarding intervention. These purposes and outcomes strengthen the previously discussed categorization in terms of intervention dimensions and emphasize the finding that information interventions and socialization interventions were the most common type of digital and virtual onboarding interventions. Furthermore, the identified purposes and outcomes support the conclusion that digital and virtual onboarding interventions are an essential tool for higher education institutions.

Along with the onboarding dimensions, we also mapped and categorized the onboarding settings. According to our investigation, most of the onboarding interventions reviewed relied on the use of telecommunication software; in the next place were virtual environments. These findings were in line with the current technological standards identifying telecommunication software as a vital and indispensable part of modern society [57]. In particular, research has identified a growing technological trend involving the application of virtual environments and realities in higher education settings in recent years [58]. These two technologies have also been shown to improve interaction between people, as well as the transmission of large quantities of information [59–61], underlining our previously mentioned key finding that information transmission and socialization for incoming students were the main purposes and outcomes of onboarding interventions. Another interesting finding concerning the onboarding settings was that most onboarding interventions in this scoping review used multiple onboarding settings together in their application. This phenomenon can be attributed to the reliance of one type of technology on other types, along with the recognized practice of higher education institutions of using single interventions to achieve multiple purposes [62].

4.1. Study Implications

Our findings have broad implications for the planning and realization of future onboarding interventions in universities and colleges. Not only does this scoping review give an overview of existing onboarding interventions, which could be used by universities and colleges around the globe, but it also categorizes these interventions. In this categorization, we learned that current onboarding interventions for first-year higher education students can be divided into four dimensions of interventions: information interventions, socialization interventions, counseling interventions and self-study interventions. From these four intervention dimensions, information and socialization interventions were the most commonly reported. Furthermore, the transmission of information and the socialization of incoming students were also frequently mentioned purposes and outcomes of onboarding interventions, indicating their prioritization by colleges and universities. Higher education institutions can learn from these findings that there are four intervention categories in which they can develop new onboarding interventions or from which they can use already existing interventions for their digital or virtual onboarding of incoming students. This scoping review also shows the importance of targeting mainly information transmission and socialization of new students, as those were mostly mentioned as purposes and outcomes of the onboarding interventions. Notably, although counseling and self-study interventions were mentioned less frequently in the reviewed SOEs, these dimensions were nevertheless in line with positive study-related variables in the literature [50,51]. Hence, higher education institutions are advised to develop and explore these interventions in more depth in the future.

Additionally, higher education institution can learn from the previously discussed results that onboarding interventions can fit into multiple onboarding dimensions and can have purposes and outcomes beyond the transmission of information and the socialization of incoming students. With this knowledge higher education institutions can choose onboarding interventions which fit for example in the information and counseling dimension

reducing the costs by implementing one intervention instead of two. This exemplary intervention then can have the purpose and outcome of transmission of information and establishment of a sense of belonging, as was the case in the pre-orientation modules of Prior et al. [34].

While the findings concerning the categorization into onboarding dimensions, as well as the reported purposes and outcomes of the onboarding interventions, represent helpful knowledge added to the field, our examination of the onboarding settings has also provided valuable insight into the practical application of digital and virtual onboarding of first-year higher education students. Notably, most of the reviewed onboarding interventions relied on telecommunication software, and we observed a growing trend involving virtual environments. These learnings benefit higher education institutions as the market for telecommunication software is large and even provides software which is free of charge, on which to build digital onboarding interventions [5]. With readily available software and incoming students, who are mostly experienced in telecommunication software, as they grew up with this kind of technology, higher education institutions should focus on onboarding interventions which use telecommunication software to reduce costs and time in the development of an onboarding setting. In contrast, virtual environments are expensive and time-consuming to build [12], but higher education institutions can use the already existing onboarding interventions in that category to save time in creating their own. Furthermore, with the growing trend in this direction, higher education institutions could serve as pioneers of technological advancements.

The established practice of combining multiple onboarding settings for digital and virtual student orientation was another valuable finding that emerged from this review. Higher education institutions considering our results may realize that one onboarding setting may not be enough to deliver a certain onboarding intervention. Bringing different onboarding settings together increases the variability of onboarding interventions a higher education institution can apply and, with that, increase the range of purposes and outcomes which are achieved by the onboarding interventions.

Interestingly, apps and mobile applications were the onboarding settings that were least mentioned in the SOEs that we reviewed, especially considering that most modern higher education students are known to use mobile devices [45]. As an additional factor, higher education institutions' recognition of the spread of mobile devices among students has led to their use for teaching or as an independent learning technology [63,64]. The idea of extending the use of mobile devices beyond the context of learning and teaching to encompass the institutions' onboarding of incoming students opens up possible practical recommendations. For example, since apps and mobile applications are already used in other fields of higher education and can be combined with other onboarding settings, institutions should consider the potential inclusion of these settings in their future designs of onboarding interventions. In particular, choosing telecommunication software that accommodates mobile applications could allow incoming higher education students to use the onboarding interventions whenever and wherever they might desire, increasing the usability and accessibility of such onboarding interventions. The literature supports this potential as telecommunication software and mobile devices can assist and strengthen each other [65].

In practice, higher education institutions may encounter difficulty in bringing together various onboarding settings. The task becomes even more challenging in light of the multitude of available onboarding interventions belonging to different onboarding dimensions and relying on individual onboarding settings or a combination of these. Noteworthy, other higher education fields have previously overcome such challenges by developing independent digital and virtual tools. Examples include digital tools to teach distance courses [66] or foster student skill assessment [67]. Similarly, an independent onboarding tool could be built as a learning platform with a dedicated homepage, for example. Such a learning platform could include telecommunication software enabling virtual and digital chats or link to other telecommunications providers, such as Skype or Discord, which

provide partly free digital and virtual services. Additionally, making this tool compatible with mobile devices would further foster the interaction between the onboarding settings. Implementing the various onboarding dimensions might entail splitting the content of the onboarding tool into multiple parts that all target different specific dimensions. Using the onboarding process to send out information units represents one content area where the tool would support information transmission, for example, while another area would let incoming students interact with other students or academic staff through the included chat function. This possibility represents an exciting area for future practitioners to explore; the tools they develop as a result could find practical application in almost every higher education institution around the globe. Future studies should also support this developmental endeavor by evaluating the effectiveness and usability of such tools in detail.

4.2. Future Research

Future research concerning digital and virtual onboarding interventions for first-year higher education students should contribute to establishing a greater body of literature on this relatively new area of interest. The limited amount of available literature compounded the difficulty of finding suitable SOEs for this review while facilitating a comprehensive overview of all the interventions currently to be found. Thus, this initial mapping and categorization of onboarding interventions can provide a starting point for future researchers to guide their exploration of the effectiveness and usefulness of onboarding interventions. Further studies that incorporate experiments and designs featuring pre-post control and longitudinal intervention will be invaluable to fill the wide gap in the existing literature.

4.3. Limitations

The current study had several limitations. First, most of the SOEs that reported outcomes did not include descriptions of the study methodology or statistical procedures used. These omissions limit the ability to replicate the studies or generalize the findings for a broader audience, weakening the results presented in this scoping review [68]. This observation highlights the future need for additional original studies that will be carefully documented and administered. Commonly employed methodological possibilities include longitudinal and experimental research designs [69].

The second limitation was this review's small sample size and very small selection of journal articles, as only 17 independent SOEs were included in the final analysis, six of which were journal articles (along with eight conference papers, two book chapters, and one informational flyer). The problem can be attributed to the novelty of the chosen field and the specified eligibility criteria. Reasonably, a larger sample with more peer-reviewed journal articles would provide more in-depth insight into this topic and support greater confidence in the findings of the SOEs [70]. Albeit that the currently limited availability of journal articles on this topic precluded a larger sample size, this work provides a starting point for future empirical research.

5. Conclusions

This scoping review mapped and categorized current interventions in digital onboarding of first-year higher education students and therefore contributed to the growing literature on higher education administration and technology. This work also expands the knowledge on digital onboarding for first-year students in general and establishes a foundation for future research in the field.

In conclusion, we can say that various digital and virtual onboarding interventions for higher education students exist and are applied in colleges and universities worldwide. These interventions were categorized into four onboarding dimensions: information interventions, socialization interventions, counseling interventions and self-study interventions. Information interventions and socialization interventions were the largest categories of onboarding dimensions. These onboarding dimensions could act as guides for higher education institutions in choosing and developing future onboarding interventions as the

onboarding dimensions are based on the found purposes and outcomes of the onboarding interventions in this scoping review. Furthermore, the onboarding dimensions used multiple onboarding settings which can be divided into: learning platforms, homepages, virtual environments, apps and mobile applications, as well as telecommunication software. It turns out that telecommunication software and virtual environments were the predominant onboarding settings. As this scoping review described that the onboarding interventions used multiple onboarding settings together, it can be said that higher education institutions cannot keep their focus only on an onboarding setting, but rather must divide their attention as necessary.

Additionally, there is not enough research on the effectiveness of these onboarding interventions. Empirical studies are needed to draw clearer conclusions on the usefulness of these interventions. Future research should also focus on how accepted these interventions are by incoming students to determine the best practices for digital onboarding of first-year higher education students.

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Appendix A

Scopus search string:

(TITLE-ABS-KEY ("onboarding" OR "virtual onboarding" OR "digital onboarding" OR "newcomer adjustment" OR "undergraduate adjustment" OR "newcomer socialization" OR "undergraduate socialization" OR "digital orientation" OR "virtual orientation")) AND (TITLE-ABS-KEY ("student*" OR "freshmen" OR "first year" OR "beginner" OR "starter" OR "undergraduate" OR "newcomer" OR "rookie")) AND (TITLE-ABS-KEY (universit* OR colleg* OR "higher education" OR "tertiary education"))).

Web of Science search string:

((TS = ("onboarding" OR "virtual onboarding" OR "digital onboarding" OR "newcomer adjustment" OR "undergraduate adjustment" OR "newcomer socialization" OR "undergraduate socialization" OR "digital orientation" OR "virtual orientation")) AND TS = ("student*" OR "freshmen" OR "first year" OR "beginner" OR "starter" OR "undergraduate" OR "newcomer" OR "rookie")) AND TS = (universit* OR colleg* OR "higher education" OR "tertiary education")).

PsycInfo search string:

(Any Field: "onboarding" OR Any Field: "virtual onboarding" OR Any Field: "digital onboarding" OR Any Field: "newcomer adjustment" OR Any Field: "undergraduate adjustment" OR Any Field: "newcomer socialization" OR Any Field: "undergraduate socialization" OR Any Field: "digital orientation" OR Any Field: "virtual orientation") AND (Any Field: "student*" OR Any Field: "freshmen" OR Any Field: "first year" OR Any Field: "beginner" OR Any Field: "starter" OR Any Field: "undergraduate" OR Any Field: "newcomer" OR Any Field: "rookie") AND (Any Field: universit* OR Any Field: colleg* OR Any Field: "higher education" OR Any Field: "tertiary education").

BASE search string:

("onboarding" "virtual onboarding" "digital onboarding" "newcomer adjustment" "undergraduate adjustment" "newcomer socialization" "undergraduate socialization" "digital orientation" "virtual orientation") AND ("student*" "freshmen" "first year" "beginner" "starter" "undergraduate" "newcomer" "rookie") AND (universit* colleg* "higher education" "tertiary education").

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