Digital learning in physiotherapy education: Exploring design approaches through meta-analysis

Pooja Varma | Lakshyashree | Kajal Chheda | Wamika Goyal | Trapty Agarwal

Abstract  The implementation of internet-based educational designs to enhance teaching and learning could be advantageous for higher education. There is not much research on digital methods of learning in physiotherapy education. The investigation examines and assesses methods of online learning in an effort to raise the standard of physiotherapy education. An extensive meta-analysis and evaluation of both randomized and non-randomized tests are the proposed methods of the research. A map was made of the digital initiatives and research mentioned in the list. Learning impacts for similar interventions were determined by means of meta-analysis. Five cohort investigations and ten randomized controlled trials make up the total of 15 researches included in the evaluation. Blended learning, remote learning, and the flipped classroom methodology were all used in 14 studies. In all, seven of the fifteen pieces of content were referenced in the flipped classrooms have statistically significant effects on learning, according to a meta-analysis for interaction uses on useful skills. Based on the findings, integrating pedagogical approaches is equally, if not more, more efficient than a regular classroom instruction in obtaining learning objectives. Results in online education did not show any discernible variations from traditional classroom training. It has been found that space learning and integrated learning are just as effective as traditional teaching approaches, if not more so, in the field of physiotherapy education. The meta-analysis found that using student-made videos, flipped classrooms, and interactive websites improved students’ learning. Larger controlled trials are needed to validate these results. Research ought to investigate the ways in which online learning models can make possible students’ assimilation in pragmatic abilities and behaviors, facilitate their understanding of concepts, enhance their memory of contents, and cultivate methods of learning. Further, it needs to examine digital learning materials and information bases.

Keywords: physiotherapy education, blended learning, meta-analysis, digital learning models

1. Introduction

The use of technology along with virtual educational settings in physiotherapist courses’ instruction and instruction was known as online teaching. It includes a wide range of digital resources, tools, and pedagogies that improve the educational experience for students interested in a career in physiotherapy (Zhu et al 2020). Digital physiotherapy education is available through digital learning courses and modules. These classes may cover a wide range of subjects, such as anatomy, biological mechanics, musculoskeletal evaluation, therapeutic methods, and clinical practice. These courses offer flexible learning schedules because students can access them from anywhere, at any moment (Bennell et al 2021). Although the positive results support the use of online learning in physical therapy, care must be taken when extrapolating and applying outcomes for the contemporary classrooms because data samples from a social setting that is not emergency-related may not be appropriate for a locked-down a global epidemic system.

Figure 1 denotes the physiotherapy education of digital learning. Physical consultations are the traditional method of providing physiotherapist care. Yet, geographic remoteness provides a lack of local resources or a combination of both prevents several individuals from accessing physiotherapy. Psychotherapists must stay adaptable to students with a lifelong dedication to recognizing and filling up knowledge and skill gaps via metacognitive reflection and critical thinking if they are to build expertise. For the adaptable learner, continuing professional development (CPD) is crucial, registration organizations and previous scientists have separated it into formal and informal learning activities. Knowledge is a result of students comprehending and reacting to their participation in educational activities. Professional growth courses and conferences are examples of structured, can be educator-facilitated learning activities. Unstructured activities including personal reflection on experiences or workplace experiential learning are examples of informal learning. Although formal learning activities can assist
learning, limitations like cost and time can prevent involvement (Leahy et al 2020). To improve postural control in teenagers with CP, physical therapy therapies are frequently performed. Most of the current research on enhancing sitting skills in CP students has involved students older than 5 years old. Given that corticospinal growth and synaptogenesis are at their peak during the initial two years of a child’s life, the timing of interventions may have a substantial impact on their effectiveness. Additionally, The inability or challenge of obtaining unassisted sitting by the age of five signals a severe motor delay that may harm later milestones (Inamdar et al 2021).

Figure 1 Physiotherapy Education Of Digital Learning.

Tomé & Coelho (2023) developed digital tools and platforms discussed in this study including digital learning surroundings, enormous open-access courses on the internet virtual reality, digital games, simulations, and virtual reality. The route map of instructional skills is presented that draws attention to the use of cutting-edge technological advancements in physiotherapy education. Vallée et al (2020) examined efficiency for conventional and combined education in the area of health education. He et al (2021) contrasted the efficacy and approval of SDE with conventional learning for health science students and looked into any factors that might affect the combined outcomes. Kononowicz et al (2019) assessed the utility of virtual patients in health education in comparison to other types of digital learning if integrated with other types of digital learning, and when created in various methods. Barton et al (2022) assessed the expertise and comfort level of physiotherapists in treating patellofemoral pain (PFP) and knee osteoarthritis (OA), as well as investigated the learning styles and solutions for the management of various knee issues. Jones et al (2021) investigated physiotherapists’ perspectives and experiences with a telehealth videoconferencing e-learning program concerning best practice knee OA maintenance. Ortega et al 2022 presented a critical review of previous systematic evaluations analyzing digitally and hybrid curriculum implementation systems in advanced training in health and examine the application of learners, beginning stages in physical therapy education. Suso-Martí et al (2021) assessed if tele-rehabilitation could be a useful substitute for traditional rehabilitation in physical therapist training, a canopy and a cartographic evaluation utilizing meta-meta-analysis of the relevant technical proof carried out. Fernández-Carnero et al (2021) demonstrated that RUSI may be able to contribute to high measurement reliability in the lumbopelvic area with validation and dependability for evaluations, as well as demonstrating the subsequent outcomes for both treatment and diagnostics calculation on physiotherapy when contrasted to conventional approach, enabling further study in this field. (Ogbeivor and Elsabbagh 2021) evaluated the efficacy of stratified care for LBP treatment in comparison to conventional physiotherapy. Jorge et al (2021) assessed the applicability, efficacy, uptake, and execution of PEAK electronic learning components and improved the physiotherapists’ expertise in treating knee osteoarthritis (OA) via in-person sessions and telemedicine and the online learning components are developed. Physiologists in the study environment believed that e-learning methods are useful once they are a portion of a thorough teaching platform for a clinical test.

2. Methodology

Following the protocol used in this systematic investigation, the most effective commentary components for systematic evaluations and meta-analysis standards were recorded. Methodological analysis technique is entered in the international possible register of methodical investigations. Cohort investigations and randomized controlled trials with designs meeting the
following criteria were taken into consideration. These studies supplied baseline and post-therapy assessments for two study groups. (a) research with learners of physiotherapy involved with educational programs for physiotherapy; (b) evaluated a computer-based education method's results; (c) compared the outcomes with education in a conventional classroom conditions; and (d) included data to students' most recent academic standing and self-identified academic achievements. We included in our analysis only studies that employed summative assessments as the ultimate examination to measure learning outcomes as a result of competence, abilities, or impacting outcomes. research where the use of online educational skills is not part of an explicit learning method and attempts to prepare highly qualified physiotherapists for many years in the workforce.

2.1. Techniques for searching

Cinahl, Medline, Learning Resources, Embase, Teacher Reference Center, and Learning Source of a Data Center were searched. Before that year, there had been limited use of learning models in the field of physiotherapy education. Some terms that were searched and the entire screening process presented include: adaptive learning, distance learning, technological knowledge, machines. user education, computerized combination, online teaching, m-learning, or changed on the web, video games, online, hybrid, massively free online classes, transmission, collaborative, and models.

2.2. Data interpretation

The article contents were initially organized according to the research layout. The digital education technologies that are utilized are outlined in the definitions of education, and the knowledge outcomes are then taken into account to aggregate the meta-analyses’ conclusions based on how similar they are. Standard mean variations (SMDs) were used in the research when different scales were used for identical outcomes. We also computed mean variation for pool equivalent continuous results (e.g., students' satisfaction with the comprehension layout expressed). For every result, we gave the related 95 percent confidence intervals (CIs). There were two recording issues. Given that we expected the documents included to be heterogeneous, The model of unpredictability was employed for the analysis. Experiments reporting on similar demographics, interventions, and outcomes were merged into a meta-analysis. In instances where the heterogeneity of the research prevented pooling, we present the outcomes logically.

2.3. Extraction of data

Three separate investigations examined the abstracts and titles of utilizing the Rayyan website as a screening device, the articles that satisfied the selection criteriaThese experts independently evaluated every text in the appropriate sources. Discussions are held to resolve disagreements on the articles to choose until an accord was reached. The primary researcher retrieved the following data from research included, which the other two studies then verified: the research's novelists, the nation, the year of publication, the research method, population features (like educational attainment), characteristics of the intervention (like integrated or distance learning techniques), comparison to traditional instruction in schools, and results (like scores and assessment method). The discussion meeting in which all authors considered involved subsequently determined which papers will be added.

2.4. Risk of biased evaluation

Utilizing the Cochrane absence of Biased Device, we analyzed the additional RCTs' biased risk and cohort research' biased risk. Three researchers evaluated the potential for bias independently. Effectiveness, reduction, reporting, and other possible quality hazards are the five selection categories where bias is rated as high, low, or uncertain.

2.5. Analyses of data and findings

We examined 7 studies in all, with an average of 2184 individuals spread throughout 7 research projects (Figure 2) (research range from n = 115-99). The study included DPT training stage (n = 7) and entry-level graduate and bachelor's degree level students (n = 1). Figure 2 illustrates the relevant research and records PRISMA flowchart.
Figure 2 Procedure of choosing studies and records according to PRISMA flowchart.

Table 1 Studies of digital overview concepts.

<table>
<thead>
<tr>
<th>Author, decade, country, and method of research</th>
<th>Online learning design, intervention, and comparing</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett and Smith 2020, USA, RCT</td>
<td>Design for digital learning: Merged education Setting: Development of abilities on campuses Expert: Cardiovascular and pulmonary physical treatment Time limit: 45-minute experiment Mediation: groups that only employ mobile applications and groups that additionally make use of demonstrations. Five minutes dedicated to mobile apps only. Instead of a lecturer leading a training demonstration, the skills were first applied in a lab with a navigation tutorial. During the training, participants in the control group were instructed to ask questions while making observations. They also received the same lecture and spoken instructions as the trainer + smartphone application group. Five minutes. attended a lab subsequent to being given a training on iPad navigation. Contrast: Group for demonstration: throughout the trial stage, develop and display the abilities. Practical exam: The evaluation of the participants' performance and interpretation of clinical abilities was done with a pretend patient unconnected to the investigation.</td>
<td></td>
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<tr>
<td>Rocha et al 2017, Brazil</td>
<td>Design for digital learning: Combined learning Framework: Theoretic acquisition on campus Abilities: Ethics and Professional Behavior in the Discipline of Physiotherapy Time limit: For seventeen weeks, once per week Mediation: Regular classes with extra time for educational computer games akin to quizzes; the gaming session didn’t end until a fresh room with fresh questions was made. Four designs: the more resources students had at their disposal, the greater the motions can complete. Compared to regular personal instruction Written exam: Eighty queries on specific data were used in the last test; they included true/false, connections between columns, and single and multiple selection. Students’ assessment: Both the degree of contentment with the rules and the students’ perceptions of education material were evaluated utilizing a Likert scale with five points. In a range of five 1 representing meaningful learning and 5 representing.</td>
<td></td>
</tr>
<tr>
<td>Lozano-Lozano et al 2020, Spain, two-fold RCT</td>
<td>Design for digital learning: Merged learning Framework: Learning theory and developing skills on campus Abilities: Ultrasound imaging OSCE: Students' practical ultrasonography handling skills were evaluated. Written exam: 20 multiple-choice questions that assess students' theoretical knowledge; up to ten points in total.</td>
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</tbody>
</table>
Time limit: In class, learners receive four hours of theoretical teaching and a full day of practical training.  
Self-studies: 2 weeks  
Intervention: After spending four hours in the classroom studying theory, students spend an additional four hours practising. After class, you are allowed to utilize the interactive Ecofisio app or site for free. Contrast: Traditional lectures for two two-hour sessions; both teams have access to pertinent journals and books. a fortnight of independent research

Design for digital learning: Blended learning  
Framework: conceptual learning and practical instruction on campus  
Abilities: Learning practical skills  
Time limit: 1 month  
Mediation: Group 2 received their teachings on a standard PC screen, while Group 1 received theirs through 360-degree footage on the Samsung Gear VR headset following the pretest. During class, a teacher gave Group 3 traditional instruction.

Design for digital learning: Flipped classroom  
Framework: Conceptual instruction  
Subject/skills: Muscle and bone composition, patient management in the lower region  
Duration: 79 hours in the lab and 81 hours of lectures  
Mediation: flipped classes in class B and C with erratic lecture schedules; readings; pre-recorded lectures; ungraded exams; discussion questions; instructor-led case investigations and huge group questions; small group questions and case discussion; polling technology; in-class; In contrast, Class A will spend 18 hours a day in regular lectures and 31 hours in labs.

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Written exam: Ten tests in total, given every two weeks, comprised 83 multiple-choice questions (MCQs) pertinent to the subject matter covered for each of all three cohorts. Evaluations by students: Following the instruction, questionnaires were given to classes B and C with a Likert scale of 5 asking about the students' perceptions of the flipped technique.

Written exam: Throughout the three-year study period, the identical questions were asked on Exams 1 and 2, which were given at the end of each of the three units. Exam outcomes were utilized to quantify objective shifts in the comprehension of the subject.

Written exam: 120 Multiple-choice questions. Two phases made up the multiple-choice questions on the final test. “Recall” and “understand” were the definitions of lower-level multiple-choice tests (LL-MCQs), along with additional questions that required concept memorization. The descriptions of higher-level multiple-choice questions (HL-MCQ) are apply and analyze. Individuals to adapt their information to new circumstances in those

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queries, greater cognitive skills were required. Students were asked to evaluate the case details in the HL-MCQs to determine the precise position of a fracture or possible relevant indicators, like anatomic recognition on MRI images. For the duration of the subsequent kinesiology course, students in both the regular classroom format and a flipped environment completed three MCQ unit tests. No cumulative tests were offered, nor was there a final exam.

Digital learning concepts are indicated in Table 1. Interactions with a clinical teacher, timeouts, rewinds, and debriefing are some of the simulated learning exercises for clinical immersion. In various studies on blended learning, a virtual environment with storage was employed. An array of traditional, online education, and traditional classroom layouts in addition to online education, standard, and e-learning layouts made up the intervention.

![Figure 3 Utilization of digital tools between physiotherapy.](image)

<table>
<thead>
<tr>
<th>Digital tools</th>
<th>Personal</th>
<th>Professional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smartphone apps</td>
<td>97.8</td>
<td>76.4</td>
</tr>
<tr>
<td>Online Meeting tools</td>
<td>57.9</td>
<td>45.6</td>
</tr>
<tr>
<td>Smart Watches</td>
<td>18.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Other wearables</td>
<td>7.8</td>
<td>21.3</td>
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</table>

Table 2 indicates the percentage of respondents who utilized digital tools, and Figure 3 provides an overview of how respondents employed digital technology for personal or professional objectives. A significant proportion of those polled (92.1%, n = 669) and 4.8%, n = 35) reported using digital tools for personal purposes on a daily or up to five day basis, respectively. 45.3% of those polled (n = 332) said they used digital tools every day for work-related purposes, 25.8% said they used them three to five days a week (n = 189), and 28.9% said they used them ever or less than once a week (n = 212). For private uses, digital tools are used by 99% of respondents who routinely use them for work. Participants who were younger than 45 (p = 0.007) and had fewer job skills (p = 0.031) used digital tools more frequently when doing work.

Table 3 provides the percentage of usage, and Figure 4 shows the specific use of online resources by physiotherapist during the lockdown. During the lockdown, physiotherapy specifically exploited digital platforms for clinical purposes; Figure 4 shows the technologies that were most frequently used. The majority of individuals who used a remote treatment mode indicated a desire to learn more about online therapy or to receive training in it. About two thirds of those using remote physiotherapist did not use any extra security measures (such a specific informed consent form) in contrast to the already-accepted standards.
Figure 4 Particular usage of digital platforms during the lockdown.

Figure 5 Sum of consultations by service kind.

Table 3 Percentage of usage during the lockdown.

<table>
<thead>
<tr>
<th>Specific use of digital tools during the lockdown</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>History taking</td>
<td>29</td>
</tr>
<tr>
<td>Examination</td>
<td>24.9</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>14.7</td>
</tr>
<tr>
<td>Prognosis</td>
<td>13</td>
</tr>
<tr>
<td>Treatment</td>
<td>62.5</td>
</tr>
<tr>
<td>Patient education</td>
<td>75.8</td>
</tr>
<tr>
<td>Follow up</td>
<td>62.8</td>
</tr>
<tr>
<td>Treatment adherence</td>
<td>31.5</td>
</tr>
<tr>
<td>Monitoring</td>
<td>32.6</td>
</tr>
</tbody>
</table>
Table 4 shows the proportion of consultations by service, whereas Figure 5 shows the total number of consultations by kind of service. Ninety-nine patients on average expressed enthusiasm for using the virtual service, of which fifty-one (57%) were referred by others. Of the ninety patients in this group, thirty-one (34%) chose to wait for the return of personal assistance, while sixty-one (68%) chose the virtual service. Of the participants, 38 (63%) made reference to the digital service for the first time, whereas the others had previously used the conventional service before to the lockdown and chose to convert to the online service. Throughout the course of the study, those 60 patients visited 242 consultations in total, with an average (standard deviation) in 5.0 (5.0) per patient within the same time period, the clinic conducted 5958 standard in-person consultations with 1267 patients, including group classes that were physically segregated. Virtual services peaked in the months of March and April of 2022, but they suddenly started to decline in June when the NSW government began to lift lockdown laws. The decrease in digital services corresponded with the growth of traditional physical facilities.

<table>
<thead>
<tr>
<th>Months 2022</th>
<th>Virtual</th>
<th>In Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 2022</td>
<td>40</td>
<td>400</td>
</tr>
<tr>
<td>April 2022</td>
<td>52</td>
<td>597</td>
</tr>
<tr>
<td>May 2022</td>
<td>64</td>
<td>902</td>
</tr>
<tr>
<td>June 2022</td>
<td>76</td>
<td>1002</td>
</tr>
<tr>
<td>July 2022</td>
<td>79</td>
<td>1195</td>
</tr>
<tr>
<td>August 2022</td>
<td>88</td>
<td>993</td>
</tr>
<tr>
<td>September 2022</td>
<td>95</td>
<td>890</td>
</tr>
</tbody>
</table>

3. Conclusion and Implications

This research analysis indicated that hybrid learning and remote learning arrangements are used in physiotherapy education. The results show that mixed learning approaches, which combine learning with the development of practical skills, are either more or less efficient than traditional classroom instruction in physiotherapy learning. However, the results of the one remote learning technique were similar to those of traditional classroom training. The results of the meta-analyses demonstrated that the student learning was improved by the interventions that used student-made videos, flipped classrooms, and communication apps. To validate these results, more thorough investigation is required. The scope of this conclusion’s generalizability is restricted by the physiotherapy population that the analysis addressed. The need for more effective practical approaches in future research is highlighted by this analysis. Additional comprehensive study, including experimental designs are required for it. Further researches can also integrate managerial components and arithmetical approaches of characterizing the outcomes that make use of flipped classroom concepts. Further in-depth and continuous research studies to investigate students’ learning and retention strategies as well as their approaches to learning in an online learning setting would also be beneficial. The attitudes of educators about establishing and executing technologies for obtaining education in physiotherapy should also be investigated by researchers.

Ethical Considerations

Not Applicable.

Conflict of Interest

The authors declare no conflict of interest.

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References


