**Using Digital Technologies to Support** **Active and Self-Directed Learning**

***Background:*** Digital technologies hold significant promise in fostering both active and self-directed learning. The understanding of to what extent how educators in higher education employ digital technologies for these objectives is still in its nascent stages.

***Purpose:*** The study's objective was the scrutiny of techno-pedagogical competencies among college teachers concerning the facilitation of active learning and self-directed learning. Additionally, an exploration into teachers' conceptualizations of self-directed learning employing digital technologies was undertaken.

***Sample:*** The research population included 156 teachers representing diverse academic disciplines across five Israeli teaching colleges.

***Design and method:*** Our research employed a blended methodology, integrating both quantitative and qualitative approaches. We utilized an online questionnaire, tailored for this study, that enabled teachers to self-assess their familiarity with and utilization of digital technologies comprehensively. Additionally, we conducted semi-structured interviews that explored teachers' perceptions of digital learning and self-directed learning.

***Results:*** Teachers primarily utilize digital technologies to enhance their instructional methods and to fostering active learning and collaboration among students. Notably, a limited number of educators, possessing advanced techno-pedagogical skills, actively encourage self-directed learning by involving students in the selection and adaptation of digital tools. The interview results reveal that teachers' pedagogical perspectives on self-directed learning often lack depth and neglect providing students with choices. Teachers emphasize the significance of group and collaborative learning in the digital realm. To further promote self-directed learning, they mainly propose group assignments and collaborative creation of digital products.

***Conclusions:*** The integration of digital technologies for fostering active and self-directed learning is in its early stages. It is essential to enhance technological skills and promote a pedagogical understanding of the significance of direct learners' involvement in using and selecting the digital tools adapted to their educational needs. This dual approach will contribute to active and self-directed learning methodologies in a digital learning and teaching.

**Keywords:** digital learning and teaching; active learning ; self-directed learning;techno-pedagogical competencies

**Theoretical background**

Active learning and self-directed learning represent intertwined and complementary educational methodologies. Active learning denotes a learner-centric process wherein individuals assume a central role, employing entrepreneurial strategies and personal investment to catalyze learning processes (Morris, 2019). Conversely, self-directed learning centers on the learner's capacity to autonomously activate learning processes, encompassing planning, needs and goal assessment, and evaluation procedures (Gureckis and Markant 2012).

Scholarly investigations indicate that active learning affords students opportunities to engage with diverse and meaningful tasks, fortifying their perspectives and expanding their knowledge base (Geng, Law, and Niu 2019). Additionally, self-directed learning endows students with the capability to take control of their learning journey, nurturing autonomy and skills for lifelong learning (Gureckis and Markant 2012).

The amalgamation of active learning and self-directed learning allows educators to cultivate an environment fostering student engagement, critical thinking, and a profound understanding of the subject matter. This synergy empowers students to actively participate in their learning, resulting in more effective and meaningful educational outcomes (Freeman et al. 2014; Wang and Wegerif 2019; Morris and Rohs 2021; Morris 2019).

Digital technologies encompass diverse hardware and software facilitating communication, access, transmission, and storage of information in a digital milieu. These technologies possess the potential to foster active and self-directed learning across various educational settings, enabling students to enhance the learning process and elevate academic performance (Morris and Rohs 2021). Through technology, students leverage distinct learning approaches, advancing research and information access in a more convenient and accessible manner (Haleem and others 2022).

The adoption of digital technologies within higher education has witnessed a notable surge in the post-pandemic era (Lockee 2021). A prevailing trend in many higher education institutions involves the integration of distance learning with face-to-face instruction, commonly referred to as blended learning. Geng, Law, and Niu's investigation (2019) discerned that students immersed in a blended learning environment exhibit heightened levels of social participation and cooperative interactions within the classroom. Moreover, their research underscores the substantial and direct influence of self-directed learning on the cognitive presence of students within the blended learning milieu. Notably, the technological preparedness of students is posited to exert a discernible impact on the instructional efficacy within integrated learning environments.

Wekerle's scholarly inquiry (2022) corroborates the positive influence of digital technologies on student learning within higher education, particularly accentuating the efficacy when educators utilize these technologies to stimulate student engagement in constructive and interactive learning activities. Furthermore, it is asserted that technology use directly contributes to fostering self-directed learning and augmenting student engagement (Rashid and Asghar 2016).

The utilization of digital tools for learning in higher education may exhibit heightened efficacy when students actively participate in selecting tools tailored to their individualized learning needs. Digital tools, attuned to personal learning preferences, hold the potential to furnish more precise solutions to the unique requirements of each student, thereby fostering a climate conducive to self-directed learning (Bullock 2013). Damşa (2020) and García-Martínez at el. (2020) underscore the pivotal role played by digital tools in configuring students' learning trajectories and the cultivation of personalized learning environments. Schmid and Dominik (2019) further substantiate these assertions, demonstrating that the integration of digital technologies within personalized learning environments correlates with an enhancement in self-reported digital skills and a reinforcement of beliefs concerning the utility of digital tools in the learning process. Perera and Gardner (2018) augment these findings by shedding light on the reciprocal interplay between digital literacy and self-regulated learning. Their work suggests that the deployment of personalized digital tools holds the potential to fortify both aspects. In synthesis, these investigations propose that students' active engagement in the selection of digital tools for their learning endeavors can serve as a facilitator for self-directed learning, endowing students with the requisite resources and autonomy to sculpt their own learning experiences.

In harnessing the potential and benefits of digital technologies for the advancement of active and self-directed learning, inherent challenges and limitations emerge. Learners face the imperative of cultivating learning and teaching flexibility, fostering familiarity with diverse tools, and navigating the intricacies of technological complexities. The realization of these objectives necessitates comprehensive training and continual support, particularly in the development of information literacy skills to adeptly navigate the burgeoning volume of available information (Santos, Batista, and Marques 2019a; Aldahdouh, Nokelainen, and Korhonen 2020; Santos, Batista, and Marques 2019b; Spante and others 2018).

Despite the widespread adoption of digital technologies by students in higher education, recent studies underscore a persistent underutilization by educators (Mercader and Gairín 2020). Handerson et al. (2017) explored students' experiences with digital technology, identifying 11 distinct digital benefits while suggesting that these technologies fall short of transforming the fundamental nature of university teaching and learning. Additional research reveals that teacher educators tend not to prioritize digital tools for pedagogical purposes, emphasizing the necessity for extensive pedagogical support in digital teaching endeavors (Amhag, Hellström, and Stigmar 2019; Pinto and Leite 2020). Notably, faculty members rate the administrative learning management systems as the most crucial and competent digital technology for administrative needs (Martin and others 2020).

Mercader and Gairín (2020) highlight pervasive barriers impeding teachers' utilization of digital technologies, encompassing personal, professional, institutional, and contextual factors, with professional barriers emerging as the most prevalent. The perceptions of these barriers significantly influence teachers' engagement with technology. The professional use of digital tools strongly aligns with teacher educators' attitudes toward digital technology, where attitudes exert a more profound impact than digital competence on the extent to which digital tools are employed (Madsen, Thorvaldsen, and Archard 2018). Notably, in evaluation processes, teachers' beliefs regarding learning and technology play a pivotal role in either facilitating or hindering the integration of technology (Romero, Plaza, and Orfali 2019).

The present study conducted during the academic years 2022-2023, aligns with a notable surge in the integration of digital technologies within Israeli higher education in response to the ramifications of the Corona epidemic. The research's salience lies in its dedicated examination of digital technologies' utilization for fostering active and self-directed learning. The study's objective was the scrutiny of techno-pedagogical competencies among college teachers concerning the facilitation of active learning and self-directed learning. Additionally, an exploration into teachers' conceptualizations of self-directed learning employing digital technologies was undertaken to discern their attitudes. The specific research questions were:

a. What are the primary purposes for which educators deploy digital technologies in their teaching, and to what extent is such integration observed?

b. To what degree do educators engage learners in the selection and utilization of digital technologies to cultivate active and self-directed learning, and how does this compare across educators who do not involve learners?

c. How do educators define self-directed learning, and is its realization feasible, and if so, how can it be effectively promoted through the integration of digital technologies?

**Methodology**

The study employed a comprehensive research methodology, integrating both quantitative and qualitative approaches (Creswell and Creswell 2017). The quantitative facet of the investigation is underpinned by the premise that employing a sizable sample allows for the extrapolation of findings to broader populations. In parallel, the qualitative component aspires to elucidate the unique personal perspectives of educators, thereby fostering a nuanced comprehension of the examined phenomenon.

***The research population***

The research population included 156 teachers representing diverse academic disciplines across five Israeli teaching colleges. These institutions exhibit distinct profiles: two are sectarian, exclusively serving Jewish cohorts, two are secular for both Jewish and Arab students, and one is dedicated solely to Arab students. Most of the teaching faculty boasts a substantial teaching tenure, exceeding six years, involving the delivery of a minimum of five courses annually. A comprehensive overview of the study population's attributes is summarized in Table 1. which also includes the distribution of age, gender, academic qualifications and professional rank.

[Table 1 near here]

***The research tools***

A. *Questionnaire***:** An online questionnaire tailored for this study comprised 18 questions, allowing teachers to self-assess their familiarity and utilization of digital technologies across various professional contexts. Constructed with inspiration from the SELFIE (Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies) framework for teachers' questionnaires (Kampylis, Punie, and Devine, 2015), this tool, developed by the European Commission's Joint Research Center (JRC), aids educators in reflecting on their digital competence. The SELFIE questionnaire comprising 34 questions, served as the foundation for our focused 18-question instrument, centering on teaching practices. Areas explored included for example the creation and modification of digital resources, the use of digital technologies for feedback and reflection, and the enhancement of collaboration among learners. Each question offered five response options, ranging from non-use to active student involvement—a crucial aspect aligned with the study's primary objective.

Additionally, the questionnaire featured background inquiries on gender, age, seniority, and field of teaching, among others (see the attached questionnaire in the appendix). Distributed via email to approximately 500 teachers, the questionnaire garnered responses from 156 participants, yielding a response rate of about 30%.

*B. Semi-structured Interview:* Ten teachers, chosen for their consistent integration of technology in teaching across diverse subjects and experiences, participated in face-to-face or Zoom semi-structured interviews, each lasting approximately 45 minutes. The interviews aimed to glean insights on three key questions: 1. Identifying crucial elements for learners in digital learning. 2. Defining self-directed learning from the interviewee's perspective. 3. Enumerating teaching methods and activities that facilitate active and self-directed learning through digital technologies.

***Data analysis***

1. *The questionnaire*: Frequencies were computed for each question and background variable within the study population. Subsequently, factor analysis was employed, utilizing Principal Axis Factoring (PAF) for extraction and the Promax rotation method. This method facilitated correlation between dimensions, particularly non-orthogonal rotation in the presence of multiple dimensions. The outcome of the factor analysis revealed four distinct dimensions (Table 3), and their interrelation was examined using Pearson's correlation analysis.
2. *The Interviews*: The interviews underwent a thorough analysis involving the identification of central themes. Employing content analysis facilitated an exploration of the inner experiences, shedding light on the perceptions and actions of the interviewed teachers while enabling the derivation of valid conclusions for their broader context (Krippendorff 2018). In the analytical phase, two researchers, designated as the first and second authors, individually scrutinized all interview transcripts. They categorized responses based on teachers' answers to each of the three questions posed. The reliability assessment employed the "reliability between judges" framework (Lincoln and Guba 2000). In instances of discordant opinions, a deliberative process ensued until consensus was achieved. The reliability measure between the judges demonstrated a substantial 88%.

**Finding**

***Area of utilizing digital technologies***

Table 2 summarizes the four domains in which teachers employ digital technologies for their work. The most prominent use is for promoting instructional methods (M=3.63). Many teachers create and adapt digital resources for instructional purposes, such as editing text, digital images, and presentations. They utilize cloud-based storage to share information with other teachers and employ electronic sheets for collecting and analyzing learning outcomes. Teachers also engage in digital technologies fostering active learning and collaboration among learners (M=3.24). They utilize collaborative files and presentations, WhatsApp, forums, digital games, digital portfolios, and more. The third domain involves the use of digital technologies to a lesser extent for assessment and feedback (M=3.12), such as through Google Forms, quizzes, and online surveys. The least utilized digital resources are those addressing diversity among students and those with special needs (M=2.27). Only a small percentage of teachers provide digital resources or create tasks with customized difficulty levels.

[Table 2 near here]

We found a positive correlation between dimensions representing the four domains (Table 3). In other words, teachers who use digital resources for one purpose, such as advancing their teaching, also utilize digital tools for collaborative learning, assessment, feedback, and addressing diversity among learners. Teachers with high techno-pedagogical skills in one domain exhibit high proficiency in other areas as well. The highest correlation was observed between the use of digital tools to promote active learning and collaboration among learners and their use for assessment and feedback.

[Table 3 near here]

# ***The distribution of teachers according to techno-pedagogical levels***

Table 4 meticulously delineates the distribution of teachers based on their techno-pedagogical proficiency in employing digital technologies for specific educational purposes. The findings reveal that a substantial majority of teachers (76.1%) adeptly employ communication tools such as e-mail, forums, and WhatsApp to facilitate interactions among learners. Equally noteworthy is the significant proportion of teachers (66.1%) utilizing digital platforms to generate educational content, employing mediums such as presentations, videos, and more. As anticipated, a considerable portion of educators (approximately 65%) engages with distance learning technologies, exemplified by the widespread utilization of platforms like Zoom.

Conversely, the analysis brings attention to a relatively modest cohort of teachers who leverage digital resources for addressing learner differences (25.0%), ensuring material accessibility (25.5%), and solving pedagogical challenges (32%). This observation underscores a discernible gap in the integration of digital tools for these specific purposes.

Furthermore, a noteworthy segment of teachers remains either unacquainted with or minimally acquainted with technological tools. For instance, over 30% of teachers abstain entirely from utilizing digital tools for providing feedback or conducting assessments, analyzing and curating learning materials, fostering creative learning through digital games, or problem-solving. Remarkably, about 35% of teachers refrain from utilizing Zoom altogether or have only made sporadic attempts, primarily for distance learning endeavors.

The pivotal insights of this study are encapsulated in the fifth column of Table 4, elucidating the prevalence of teachers exhibiting the highest techno-pedagogical proficiency. These instructors not only leverage a diverse array of digital tools but actively engage their learners in the selection and utilization of these tools. This collaborative approach fosters self-directed learning, elevating both cooperation levels and active participation among students. However, the cohort of educators embodying such practices remains relatively limited, underscoring a discernible disparity compared to those who employ tools without direct learner involvement.

For instance, 32% of teachers utilize digital tools for planning and managing learner activities, yet only 17% extend encouragement for learners to independently choose digital tools for managing their own educational journey. Notably, this disparity is less pronounced in areas where direct learner involvement is imperative, such as promoting communication and collaboration among learners or facilitating content creation. In these domains, the divide between educators who involve learners directly and those who do not exhibits a marginal difference.

[Table 4 near here]

# ***Analysis of Teacher Interviews***

*Key components for learning in a digital environment*

The most important components for learning in a digital environment according to the teachers' answers are summarized in Table 5. The findings illuminate the multifaceted perspectives of educators concerning technological, pedagogical, and personal components essential for effective learning in the digital realm.

Technological proficiency stands out as a cornerstone, with unanimous agreement among teachers regarding the necessity for digital orientation. This entails mastery over tools, ensuring accessibility, and a prevalent emphasis on the availability and user-friendly nature of these tools. In the realm of pedagogical considerations, 70% of teachers underscored the heightened significance of group and cooperative learning in the digital landscape. Moreover, a noteworthy portion (50%) highlighted the crucial role of continuous feedback and reflection for optimal learning outcomes in a digital environment.

Within the domain of personal components, a recurring theme in teachers' responses is the imperative of fostering curiosity and motivation for learning. Almost all teachers emphasized these intrinsic qualities as pivotal for learners navigating the digital terrain. Notably, a smaller cohort of educators (three teachers) accentuated the importance of instilling critical thinking skills and nurturing a sense of responsibility for managing one's learning journey, identifying these factors as key contributors to success in a digital learning environment.

[Table 5 near here]

*Defining self-directed learning*

The teachers in this study were asked what self-directed learning is according to their perception. Ninety percent of the surveyed teachers concisely characterized self-directed learning as the adeptness to independently study, navigate information, critically evaluate it, and adeptly organize and synthesize it. This is how a chemistry teacher, for example, defined it: "The confidence to approach the material and bring it alone to know each time what needs to be done with it, develop it as learning or learn it personally."

A subset of educators (30%) posited that the viability of self-directed learning hinges on internal motivation and a predisposition for learning, aligning with the assertion that independent learning derives from an intrinsic drive propelling learning endeavors. As one science teacher articulated, " self-directed learning is not an obligatory task but an internal engine propelling learning forward."

Moreover, a distinct cohort of educators (20%) accentuated the symbiotic relationship between independent learning and guidance, underscoring the importance of mentorship and direction from academic authorities in fostering a balanced and effective learning experience.

*Fostering active and self-directed learning through digital technologies*

In Table 6, a synthesis of teachers' recommendations unveils diverse strategies for nurturing active and self-directed learning through digital technologies. Notably, 80% of the teachers underscored the significance of cooperative learning. This involves collaborative group tasks, fostering joint production of various artifacts, such as files, presentations, and videos. The teachers emphasized the use of the Moodle platform where tasks, forums and more can be integrated.

Additionally, 50% of the teachers advocated for activities leveraging smartphones and diverse applications, coupled with the integration of social networks to facilitate seamless information sharing among students. A further 30% of educators highlighted the efficacy of digital games in promoting engagement and self-directed learning. Equally, a comparable percentage of teachers emphasized the importance of continuous digital feedback mechanisms.

Interestingly, a mere two teachers expressed the belief that affording students' choices could significantly contribute to cultivating an environment conducive to self-directed learning.

[Table 6 near here]

**Discussion**

# The present study aimed to assess the techno-pedagogical proficiency of teachers within teaching colleges, specifically focusing on the facilitation of active and self-directed learning. Our investigation delved into the utilization of digital tools by educators and the purposes for which they are employed. Notably, the predominant objective among teachers employing digital tools was the enhancement of teaching practices. It is evident that tools supporting face-to-face instruction, such as presentations, information retrieval tools, and resources for analyzing learner products, were more readily embraced (Pinto and Carlinda 2020; Mei, Aas, and Medgard 2019).

In contrast, our findings reveal a limited use of digital resources by teachers in addressing student disparities and accommodating special needs. Tasks of varying difficulty levels and problem-solving tools were underutilized. This underscores the imperative to fortify teachers' competencies in leveraging open digital technologies, fostering inclusivity for all learners.

Promisingly, the study uncovered a substantial utilization of digital tools fostering active and collaborative learning, including collaborative files, presentations, WhatsApp, forums, and digital games. These diverse applications highlight the multifaceted role of digital tools. However, it is noteworthy that a modest proportion of teachers involve students in selecting and utilizing these tools, emphasizing the potential of student participation in shaping a constructive and self-directed learning environment.

Popa and Topala (2018) observed a positive correlation between students' self-directed learning and higher self-perceived digital competencies, linked to elevated self-efficacy. Rashid and Asghar (2016) affirmed that technology usage positively influences self-directed learning and student engagement, indirectly impacting academic performance. Web 2.0 tools and open digital platforms fostering collaboration were identified as significant predictors of self-directed learning with technology (Şumuer 2017). Shinkareva (2007) found a positive relationship between instructional technology competency and self-directed learning ability in adult students. Students actively engaging in selecting digital tools tailored to their learning needs demonstrate enhanced self-directed learning (García-Martínez, 2020; Schmid and Dominik 2019; Perera and Gardner 2018).

In the current study, while many teachers employ tools encouraging cooperative and active learning, a minority effectively promotes self-directed learning in a digital environment. The positive correlation between diverse purposes of digital tool usage (Table 3) underscores that high techno-pedagogical skills correlate with elevated levels of active and self-directed digital learning promotion.

Faculty members within Institutions of higher education now possess unprecedented access to technology, teaching a student body immersed in constant personal technology use. Nevertheless, our investigation reveals a notable discrepancy, with approximately one-third of teachers abstaining from digital technology utilization. Furthermore, 20% initiated digital tool integration but discontinued.

Existing research underscores the pervasive issue of partial digital technology adoption among teachers, exposing gaps between potential and actual utilization (Polly, Drew, Martin, Florence and Guilbaud 2021; Peres, Fernando and Anabela 2017). Significantly, many educators fail to leverage digital tools for pedagogical purposes (Amhag, Hellström, and Stigmar 2019; Pinto and Leite 2020).

Digital technology's integration into higher education encounters multifaceted barriers, as illuminated by Mercader and Gairín (2020). Foremost among these are professional hindrances, primarily stemming from inadequate training and support. The imperative to manage and employ technological tools, requiring sustained support and guidance, was notably underscored by the teachers participating in our research as well. The temporal demands inherent in acquiring and implementing technological skills, coupled with the inherent tension between teaching and other professional obligations, emerge as substantial impediments (Polly and others 2021). Beyond these, challenges extend to infrastructure deficits, load shedding issues, and educators' limited exposure to digital teaching methodologies and training (Liesa-Orús and others 2020; Dougherty 2015). These collectively obstruct the seamless integration of digital technologies into teaching practices.

The impact of teachers' perceptions regarding the role of digital technologies in education significantly influences their utilization of these tools. To enhance motivation, educators must discern the pedagogical value within their teaching context, drawing inspiration from concrete, effective, and subject-oriented examples provided by experienced counterparts (Amhag, Hellström, and Stigmar 2019; Pinto and Leite 2020).

In our study, insights into teachers' perceptions were primarily derived from conducted interviews. The prevailing view among educators is that digital technologies play a crucial role in fostering cooperative and group learning. Moreover, when prompted to propose activities for promoting self-directed learning, their recommendations predominantly centered around the use of digital tools encouraging cooperative learning.

Interestingly, the perception of self-directed learning among teachers appeared limited. It was predominantly defined as the capacity to engage with study materials independently, often neglecting the essential skills of identifying and selecting appropriate learning methods. This restricted viewpoint might elucidate the scant involvement of teachers in the selection of digital tools by learners.

Teachers' perceptions of self-directed learning reflect a prevalent pedagogical approach in academia characterized by systematic teaching, teacher-centeredness, and limited flexibility (Mladenovici, Ilie, Maricuțoiu, Laurențiu and Iancu 2021). To empower teachers to enable choice and involve learners in selecting personalized tools, a shift toward a student-centered teaching paradigm is imperative. This approach fosters choice and collaboration among learners and between learners and educators, ultimately enhancing learner engagement and responsibility. The challenge lies in equipping teachers with the requisite skills, highlighting the necessity of incorporating such training within teacher education frameworks.

**Summary and recommendations**

The present research underscores the prevalent utilization of digital technologies by teachers, primarily aimed at enhancing teaching effectiveness and fostering active and collaborative learning. However, a notable fraction of teachers refrains from involving learners in the selection and application of personalized technological tools conducive to self-directed learning.

Elevated levels of techno-pedagogical skills among educators correspond to a heightened promotion of active and self-directed digital learning. Teachers underscore the paramount importance of mastering technological tools as a central component of digital learning. Consequently, it is imperative to provide ongoing support, guidance, and training to cultivate proficiency in utilizing digital resources.

Training initiatives should prioritize digital tools that address learner diversity, enhance material accessibility, and facilitate problem-solving processes. Remarkably, deficiencies in these skills persist even among educators utilizing technology for other purposes.

Teachers identify group assignments and collaborative digital product creation as the most effective activities for promoting self-directed learning in the digital realm.

Nevertheless, teachers' perceptions of self-directed learning tend to be superficial, lacking emphasis on learners' participation in choosing and adapting learning methods. To empower educators in fostering self-directed learning, targeted training programs are essential, emphasizing flexible teaching approaches that prioritize learner involvement in method selection.

Despite an increasing trend in digital tool adoption, a significant portion of teachers still abstains from incorporating digital resources in their teaching practices. Recognizing and addressing the reasons behind this reluctance, including potential fears or reservations toward technology, is crucial. Investigating the experiences of teachers who attempted but did not persist in using digital tools may unveil valuable insights and guide the formulation of effective solutions.

**Research limitations**

This study contends with two significant limitations. Firstly, reliance on self-reports from teachers introduces a potential limitation, as it remains unclear whether these reports faithfully represent the reality of their practices. Augmenting the methodology with additional tools, such as direct observations or the monitoring of learning outcomes, would enhance the depth and accuracy of the study's insights. Secondly, the diversity in the fields of knowledge and course characteristics among the participating teachers introduces variability that may impact research findings. This variability, observed in workshop courses, theoretical courses, and others, aligns with similar challenges noted in the literature (Aldahdouh, Nokelainen, and Korhonen 2020; Záhorec, Nagyová, and Hašková 2019). To address these limitations, a proposed follow-up study aims to investigate potential disparities in techno-pedagogical skills among teachers based on background variables such as field of knowledge, course nature, gender, seniority, and more. This subsequent research endeavor seeks to contribute valuable insights that may further promote the effective use of digital technologies among teachers, fostering active and self-directed learning practices.

**Acknowledgements**

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Table 1. Characteristics of the study participants (N=156)

|  |  |
| --- | --- |
| **Frequency *(%)*** | **Characteristic**  |
| 96 females (61.7%)60 males (38.3%) | Gender |
| 31-40: 19 (12.2%)41-50: 44 (28.2%)51-60: 56 (35.9%)61 and above: 37 (23.7%) | Age |
| 1. Jewish religious college, the southern region: 48 (30.8%)
2. Jewish religious college, the center region: 41 (26.3%)
3. Secular college (Jews and Arabs), northern region: 34 (21.8%)
4. Arab College, north region: 17 (10.9%)
5. Secular college (Jews and Arabs), southern region: 16 (10.3%)
 | College: characteristic and geographical region |
| Master's degree: 42 (26.9%)Ph.D: 114 (73.0%) | Education |
| General education, Education Administration: 42 (26.9%)Humanities: literature, Art, Bible: 43 (27.0%)Sciences, Mathematics, Technology: 41 (26.2%)Special education, Psychology: 33 (21.1%)Early childhood education: 14 (9.0%)English: 11 (7.6%) | Teaching discipline |
| 1-3 years: 11 (7.1%)4-6 years: 19 (12.2%)7-10 years: 31 (19.9%)11 years and above: 95 (60.9%) | Teaching experience (years) |
| 1-2 courses: 26 (16.7%)3-4 courses: 24 (15.4%)5-6 courses: 46 (29.5%)7 courses: and above: 60 (38.5%) | היקף הוראה (מספר הקורסים בשנה) Scope of teaching (number of courses per year) |
| Without an academic degree: 60 (39.0%) Lecturer rank: 54 (35.1%) Senior lecturer: 28 (18.2%) Professor: 12 (7.8%) | Academic degree |

Table 2. The dimensions of digital technology utilization

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Dimension | The questions included in dimension | Questions representing the dimension | *M* | *S.D* | *Omega* |
| Teaching methods | 1,2,3,4,9,14 | 3. Modification and adaptation of existing digital resources to improve teaching and learning (e.g. editing images from the web, editing and deleting text)9. Digital technologies to analyze learning processes and collect learning outcomes (e.g. online surveys, spreadsheets) | 3.63 | 0.75 | 0.83 |
|  |  |  |  |  |  |
| Active learning and collaboration | 6,7,13,15,16,17,18 | 6. Digital technologies to increase and encourage collaboration between learners (e.g. google docs, forums)17. Digital technologies for expression and content creation by the learners (e.g. text, presentations, audio, videos, visualizations, digital portfolio) | 3.24 | 1.00 | 0.87 |
|  |  |  |  |  |  |
| Assessment and feedback  | 5,8,10 | 10. Providing feedback to learners using digital technologies (e.g. online forms, video-based feedback) | 3.12 | 1.12 | 0.79 |
|  |  |  |  |  |  |
| Diversity and special needs | 11,12 | 12. Digital technologies to respond to differences between learners (e.g. online tools for defining personal learning goals, digital games of different degrees of difficulty) | 2.27 | 1.23 | Pearson Correlation: 0.71\*  |

\*The fourth dimension is based on only two items, therefore internal reliability is irrelevant. the correlation between the two items, which is found to be high, can be considered sufficient for measuring the consistency of the two items in representing the intended dimension.

Table 3. Correlation between the dimensions of the digital technology's integration

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dimension | Teaching methods | Active learning and collaboration | Assessment and feedback | Diversity and special needs |
| Teaching methods | Correlation | 1 | .746\*\* | .696\*\* | .539\*\* |
| Sig.  |  | <.001 | <.001 | <.001 |
| Active learning and collaboration | Correlation | .746\*\* | 1 | .783\*\* | .604\*\* |
| Sig | <.001 |  | <.001 | <.001 |
| Assessment and feedback | Correlation | .696\*\* | .783\*\* | 1 | .597\*\* |
| Sig.  | <.001 | <.001 |  | <.001 |
| Diversity and special needs | Correlation | .539\*\* | .604\*\* | .597\*\* | 1 |
| Sig.  | <.001 | <.001 | <.001 |  |

\*\*Correlation is significant at the 0.01 level (2-tailed).

Table 4. Frequency distribution of teachers' Utilization of digital technologies across various educational objectives (N=156)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Use and involve the students\*\*** | **משתמשים** | **Tried to use** | **Do not use** |  **Purpose of using digital technologies (Question no. in the questionnaire)** |
| 35 (22.7%) | 55 (35.7%) | 36 (23.4%) | 28 (18.2%) | Modification and adaptation of digital resources (3)  |
| 42 (26.9%) | 60 (38.5%) | 21 (13.5%) | 32 (20.6%) | Collaboration between learners (6)  |
| 12 (7.9%) | 63 (41.4%) | 22 (14.5%) | 55 (36.1%) | Analysis and collection of learning outcomes (9) |
| 17 (11.0%) | 45 (29.0%) | 25 (16.1%) | 68 (43.9%) |  Feedback for learners (10) |
| 26 (16.6%) | 55 (35.3%) | 37 (23.7%) | 38 (24.3%) | Feedback on the teaching (5) |
| 49 (31.4%) | 54 (34.6%) | 30 (19.2%) | 21 (13.5%) | Store and share information with teachers (4) |
| 56 (36.1%) | 62 (40.0%) | 18 (11.6%) | 19 (12.2%) | Communication between learners (16) |
| 21 (13.6%) | 49 (31.8%) | 23 (14.9%) | 61 (39.6%) | Creative learning (13) |
| 20 (13.1%) | 50 (32.7%) | 17 (11.1%) | 66 (43.2%) | Management and information evaluation by learners (15) |
| 19 (12.3%) | 49 (31.8%) | 26 (16.9%) | 60 (38.4%) | Summative and formative assessment (8) |
| 27 (17.4%) | 50 (32.3%) | 22 (14.2%) | 56 (36.1%) | Learning planning and management (7) |
| 13 (8.5%) | 36 (23.5%) | 22 (14.4%) | 82 (53.5%) | Problem solving processes (18) |
| 24 (15.8%) | 74 (48.7%) | 22 (14.5%) | 32 (21.1%) | Distance learning and hybrid learning (14) |
| 44 (28.8%) | 57 (37.3%) | 21 (13.7%) | 31 (20.3%) | Expression and content creation by the learners (17) |
| 10 (6.5%) | 29 (19.0%) | 17 (11.1%) | 97 (63.4%) | Access to digital resources for special needs (11) |
| 9 (5.9%) | 29 (19.0%) | 20 (13.2%) | 94 (61.9%) | Respond to differences between learners (12) |

\* This column summarizes the first two categories in the questionnaire: "I do not use".." and " I am aware of.."

\*\*This column summarizes the fifth category in the questionnaire and expresses the highest level of digital technologies utilization with direct involvement of the learners.

Table 5. Key components in digital learning: insights from teachers' perspectives

|  |  |
| --- | --- |
| Examples of teacher quotes | The component |
| Technological components: |
| "שהסטודנטים ילמדו לדבר בשפה. כלומר שבאמת כל הכלים וכל הסביבה הדיגיטלית תהיה באמת שפה שהם יודעים" (ז. מורה לקורסי חינוך) | Proficiency in utilizing technological tools |
| "קודם כל, קלות השימוש שלא ישברו את הראש על כל דבר, זה ממש חשוב במיוחד בקטע הדיגיטלי" (ע. מורה ליהדות) | Ease of use and availability |
| Pedagogical components: |
| "שכמה שפחות המרצה ירצה וכמה שיותר התלמידים עובדים בקבוצות על תוצרים שיתופיים.." (ר. מורה לאנגלית) | Group and cooperative learning |
| "חשוב מאוד שלסטודנט יהיה ברור מה הפידבק על כל שלב ושלב. אם זה ציון, אם זה הערה של המרצה שזה יהיה מאוד בהיר שהלומד ידע שהוא צריך לעשות 1, 2, 3 ואני אקבל על זה 1, 2, 3 זה ממש אלף-בית אחרת זה יוצר בלגן ובלבול" (מ. מורה לכימיה) | Feedback and reflection |
| Personal components: |
| "הם צריכים סקרנות. כי אם לא תהיה מידת הסקרנות מה שלא נעשה וכל הפעלולים, אני לא חושבת שזה יועיל" (א. מורה לביולוגיה) | Curiosity and motivation |
| "הדבר הכי חשוב שנדרש היום בתוך הלמידה הדיגיטלית הוא חשיבה ביקורתית, ההבנה מה נכון, מהו המידע האמין, מה פייק..." (צ. מורה לקורסי חינוך) | Critical thinking |
| "...זה לא משנה אם זה בפורום, אם זה כל דבר אחר שמעלים לרשת חייבים לקחת אחריות על הדברים.." (ז. מורה לשילוב הדיגיטל בהוראה)  | Responsibility for learning |

Table 6. Teachers' recommendations for fostering active and self-directed digital learning

|  |  |
| --- | --- |
| The proposed activity | Examples of teacher quotes |
| 1. מטלות קבוצתיות והפקה משותפת של תוצרים דיגיטאליים באמצעות:
 |  |
| * קבצים שיתופיים
 | "...משימות שיתופיות שצריך להעלות למודל. להעלות לקובץ שיתופי ולהגיב בפורום. או לצלם משהו וגם לשתף..." (ע. מורה ליהדות)"נתתי להכין סרטון קצר על משהו. צילום עצמי של למידה וניתוח.." (א. מורה לגיל הרך) |
| * מצגות
 |
| * פורומים
 |
| * הפקת סרטונים
 |
| 1. שילוב הטלפון החכם ורשתות חברתיות
 | "אני עושה למשל סקר דיגיטאלי בשיעור עצמו, עם הטלפונים. אני תמיד מעדיפה לעשות דברים עם הטלפון בגלל הזמינות ולא דברים שהם רק כזה בלפטופ.." (מ. מורה לאנגלית) |
| 1. משחקים דיגיטאליים
 | "...משחק בתחנות שבכל תחנה בעצם עשיתי קיו אר קוד והם היו צריכים לסרוק את ה QR שמוביל אותם כל פעם לדברים אחרים." (ר. מורה לאנגלית) |
| 1. בינה מלאכותית
 | "... עכשיו אני מאוד מנסה לראות איך אני משלב את כל הנושא של ה AI בלמידה ואיך עושים את זה בצורה אחראית ונכונה." (אש. מורה למדעים) |
| 1. מתן משוב רציף ויעדים קצרי טווח
 | "לא מחכים עד המבחן בשביל לתת איזה שהוא משוב, אלא באמת משוב ככה בצעדים קטנים לאורך הדרך. (מ. מורה לכימיה) |
| 1. מתן בחירה
 | "חשוב שהסטודנט יוכל לבחור קורסים...שיסביר למה הוא בחר דווקא את הקורס הזה...או לפחות בחירה של מטלות בתוך הקורס.." (מ. מורה לחינוך מיוחד) |

**Appendix: questionnaire on teacher digital practices**

Part one: background questions

A. Gender:

1. Male

2. Female

B. age:

1. 20-30 2. 31-40

3. 41-50 4. 51-60

5. 61-70 6. 70 and above

C. In my house there is:

1. At least one computer and a connection to the Internet

2. There is a computer but no Internet connection

3. There is no computer and no connection to the Internet

4. I only have a smartphone

5. Another \_\_\_\_\_\_\_\_\_\_\_\_\_\_

D. The name of the college where I teach \_\_\_\_\_\_\_\_\_:

E. education:

1. Bachelor's degree 2. Master's degree

3. PhD 4. Other \_\_\_\_\_\_

F. Academic rank:

1. Lecturer without rank 2. Lecturer

3. Senior lecturer 4. Professor

G. The number of courses you are teaching this year:

1. 1-2 2. 3-4

3. 5-6 4. 7 and more

5. Other

H. Teaching area:

1. English 2. Art, music

3. Early childhood education 4. Special education Psychology

5. Science 6. Mathematics/Physics

7. Computer science, learning technologies 8. Mekra Tosheba Vocevot Kodesh

9. Literature, language 10. Physical education

11. General education, director of education 12. Other \_\_\_\_\_\_\_\_\_\_\_\_

ninth. Additional role if any:

1. Board member 2. Department head

3. Dean 4. Rector

5. Unit head 6. Program leader

7. None 8. Other \_\_\_\_\_­­­\_\_\_\_\_

Second part:

Below are various skills related to teaching and learning with digital technologies. Please choose one option for each question, which is the most correct for you.

**Question 1**: Searching and Sorting Digital Information for Teaching and Learning Needs (e.g. search engines and digital libraries)

1. I don't engage in digital information retrieval.
2. I possess knowledge of various online search methods.
3. I have attempted to search the Internet for digital information.
4. I actively use various online tools to search for digital resources.
5. I systematically analyze and select digital resources based on specific criteria.

**Question 2:** Creating Digital Resources to Improve and Support Teaching and Learning Goals (e.g. digital text, presentations, video, audio)

1. I do not produce digital resources.
2. I acknowledge the possibility of creating resources digitally.
3. I have experimented with digital tools to create learning resources.
4. I actively produce diverse digital resources based on their unique features.
5. I apply design principles and systematic processes to create high-quality digital resources.

**Question 3:** Modification and Adaptation of Existing Digital Resources to Improve Teaching and Learning (e.g. editing web images, editing and deleting text)

1. I do not engage in changing digital resources.
2. I recognize the potential for adapting resources to meet teaching and learning needs.
3. I have attempted to modify digital resources to align with my teaching goals.
4. I actively redesign digital resources to suit specific educational requirements.
5. I involve learners in the process of modifying and adapting digital resources.

**Question 4:** Using Digital Technologies to Store and Share Information for Teaching and Learning Improvement(for example, storing and sharing information in the cloud, collaborative boards, interactive presentations)

1. I do not use digital technologies for storing or sharing information.
2. I recognize that digital technologies can support teaching and learning through information storage and sharing.
3. I have experimented with using digital technologies to enhance my teaching.
4. I actively use digital technologies to improve teaching and learning experiences.
5. I involve learners in adapting these digital technologies to improve teaching and learning.

**Question 5:** Using Digital Technologies for Feedback and Reflection on Teaching(for example, chat, online form such as Google Forms or Microsoft Forms)

1. I do not utilize digital technologies for feedback and reflection on my teaching.
2. I acknowledge that digital technologies can be used for providing and receiving feedback on teaching.
3. I have experimented with using digital technologies for feedback on my teaching.
4. I actively use digital technologies to give and receive feedback in real-time and/or asynchronously.
5. I engage learners in providing feedback through digital technologies, promoting self-evaluation and peer feedback.

**Question 6**: Using Digital Technologies to Encourage Collaboration Between Learners (for example, collaborative files, collaborative presentations)

1. I do not engage in collaborative activities using digital technologies.
2. I acknowledge the potential of digital technologies to enhance collaboration among learners.
3. I have experimented with using digital technologies to support collaborative activities.
4. I actively use digital technologies to facilitate collaborative learning experiences.
5. I empower learners to select digital technologies that best support collaborative learning.

**Question 7:** Using Digital Technologies to Promote Learning Planning and Management (for example, planning and setting goals using a digital diary, providing choices, directing to self-learning spaces)

1. I do not utilize digital technologies for promoting learning planning.
2. I recognize the potential of digital technologies to facilitate learning planning.
3. I have attempted to use digital technologies to support learners in planning and managing their learning.
4. I actively use digital technologies to assist learners in planning and managing their learning.
5. I encourage learners to choose digital technologies for managing and planning their learning.

**Question 8**: Using Digital Technologies to Support Formative and Summative Assessment (for example, online quizzes, assessment and feedback platforms)

1. I do not employ digital technologies for formative or summative assessment.
2. I am aware that digital technologies can effectively support both formative and summative assessment.
3. I have experimented with using digital technologies for formative or summative assessment.
4. I actively use digital technologies for effective formative and summative assessment.
5. I involve learners in constructing and planning evaluation methods and selecting digital technologies for assessment.

**Question 9**: Using Digital Technologies to Analyze Learning Processes and Collect Learning Outcomes (e.g. online surveys, spreadsheets)

1. I do not use digital technologies to analyze learning processes and collect learning outcomes.
2. I am aware of digital technologies that can reflect learning processes and outcomes.
3. I have attempted to use digital technologies to analyze individual or group learning activities.
4. I actively use digital technologies to collect learning outcomes and analyze learning activities.
5. I involve learners in the analysis of their learning data to plan further learning.

**Question 10**: Providing Feedback to Learners Using Digital Technologies (for example, online forms such as Google Forms, video-based feedback, online surveys on platforms such as Moodle, Google Sites, Teams)

1. I do not provide feedback to learners using digital technologies.
2. I recognize that digital technologies can be effective tools for providing feedback.
3. I have experimented with using digital technologies for providing feedback to learners.
4. I actively use digital technologies, including automatic feedback, for providing feedback to learners.
5. I involve learners in the use and choice of digital technologies for feedback.

**Question 11**: Ensuring Access to Digital Resources for Special Needs (for example, ensuring accessibility to files that can be scanned by software such as Word, access to infrastructure, adapted technologies such as screen readers)

1. I do not incorporate digital technologies in this context.
2. I am aware of digital technologies supporting learners with special needs.
3. I have attempted to use adaptable digital technologies for learners with special needs.
4. I actively use digital technologies tailored for learners with special needs.
5. I involve learners in selecting and utilizing digital technologies adapted to special needs.

**Question 12**: Using Digital Technologies to Respond to Differences Between Learners (for example, online tools for defining personal learning goals such as a personal online form, digital tasks of different levels of difficulty)

1. I do not employ digital technologies to personalize learning paths.
2. I recognize the potential of digital technologies for personalized learning.
3. I have experimented with digital technologies allowing personalized learning.
4. I actively use various digital technologies to address individual learning needs.
5. I collaborate with learners in creating personalized learning plans using digital technologies.

**Question 13**: Using Digital Technology to Promote Creative Learning (for example, digital games and escape rooms, virtual worlds, digital portfolio on platforms such as Pinterest)

1. I do not use digital technologies to foster creative learning.
2. I acknowledge the role of digital technologies in promoting creative learning.
3. I have tried using digital technologies to stimulate creative learning.
4. I actively use various digital technologies to encourage creative learning.
5. I involve learners in selecting digital technologies that promote creative learning.

**Question 14**: Using Resources and Digital Tools for Distance and Hybrid Learning for example, online meetings using Zoom or Teams, virtual laboratories)

1. I do not use digital technologies in this context.
2. I recognize that digital technologies can facilitate various learning modalities.
3. I have experimented with digital technologies for distance and hybrid learning.
4. I actively use diverse digital technologies facilitating distance and integrated learning.
5. I involve learners in choosing suitable tools for distance and blended learning.

**Question 15**: Using Digital Technologies for Searching, Managing Data, and Evaluating Information (e.g. searching for digital information, evaluating information, comparing sources, reading graphs).

1. I do not use digital technologies in this context.
2. I am aware of digital technologies improving information literacy.
3. I have attempted to use digital technologies for activities involving information and data.
4. I actively implement activities requiring learners to search, evaluate, and manage information.
5. I involve learners in selecting technological tools for information searching, managing, and critical evaluation.

**Question 16**: Digital Technologies for Communication Between Learners (e.g. email, WhatsApp, forum)

1. I do not use digital technologies in this context.
2. I recognize digital technologies enhancing communication between learners.
3. I have tried using digital technologies to encourage learner communication.
4. I actively implement activities requiring learners to communicate digitally based on learning needs.
5. I involve learners in selecting digital technologies for communication.

**Question 17**: Digital Technologies as a Means of Expression and Content Creation by the Learners (such as text, presentations, audio, videos, visualizations, digital portfolio)

1. I do not use digital technologies in this context.
2. I am aware of digital technologies enabling learners to produce content and express ideas.
3. I have attempted to use digital technologies to encourage learners in content creation.
4. I actively use digital technologies allowing learners to produce content and express ideas.
5. I involve learners in the use and selection of digital technologies for encouraging digital expression.

**Question 18**: Digital Technologies to Promote Learning to Solve Problems by the learners (such as text, presentations, audio, videos, visualizations, digital portfolio)

1. I do not use digital technologies in this context.
2. I am aware of digital technologies encouraging learners to understand and solve problems.
3. I have attempted to use digital technologies for activities promoting problem-solving.
4. I actively use digital technologies enabling learners to apply problem-solving processes.
5. I involve learners in adapting digital technologies for the benefit of problem-solving processes.