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

***Background:*** Digital technologies hold significant promise for fostering both active and self-directed learning. However, understanding of how and to what extent educators employ them in higher education to meet this dual objective remains nascent.

***Purpose:*** This study explored techno-pedagogical competencies among college educators for facilitating active and self-directed learning. Additionally, it examined their conceptualizations of self-directed learning entailing the use of digital technologies.

***Sample:*** The research population comprised 156 educators at five Israeli teaching colleges, wo represented diverse academic disciplines.

***Design and method:*** We employed a blended methodology, integrating quantitative and qualitative approaches. A questionnaire tailored for this study was administered online, which enabled comprehensive self-assessments of respondents’ familiarity with and utilization of digital technologies. Additionally, semi-structured interviews were conducted to explore the educators’ perceptions of digital and self-directed learning.

***Results:*** Educators primarily deployed digital technologies to enhance their instructional methods and foster active learning and collaboration among students. Notably, few educators possessed advanced techno-pedagogical skills and actively encouraged self-directed learning by involving students in the selection and adaptation of digital tools. The interview findings revealed that their pedagogical perspectives on self-directed learning often lacked depth, and they did not provide their students with choices. However, the respondents emphasized the significance of group and collaborative learning in a digital milieu. They proposed advancing self-directed learning primarily through group assignments and the collaborative creation of digital products.

***Conclusions:*** The integration of digital technologies for fostering active and self-directed learning is still at an early developmental stage. It is essential to enhance technological skills, while simultaneously fostering a pedagogical understanding of the significance of direct learners’ involvement in the use and selection of digital tools adapted to their educational needs. This dual approach will contribute to active and self-directed learning methodologies applied within a digital learning and teaching environment.

**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 is a learner-centered process wherein individuals are personally invested and assume a central role, employing entrepreneurial strategies to catalyze learning (Morris, 2019). Self-directed learning hinges on the learner’s capacity to activate learning processes autonomously and encompasses planning, assessments of needs and goals, and evaluation procedures (Gureckis and Markant 2012).

Scholarly investigations have shown that active learning enables students to engage in diverse and meaningful tasks, thereby fortifying their perspectives and expanding their knowledge base (Geng, Law, and Niu 2019). Self-directed learning also endows students with the capability to take control of their learning journeys, cultivating autonomy and skills for lifelong learning (Gureckis and Markant 2012).

Using an amalgamation of active and self-directed learning methodologies, educators can create an environment that fosters students’ engagement, critical thinking, and a deep understanding of the subject matter. This synergy empowers students to participate actively 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 comprise diverse hardware and software, which facilitate communication, access, transmission, and storage of information within a digital milieu. They can potentially foster active and self-directed learning across different educational settings, enabling students to enhance their learning process and improve their academic performance (Morris and Rohs 2021). Technology enables students to leverage distinct learning approaches, thereby advancing research and facilitating convenient access to information (Haleem et al. 2022).

In the post-pandemic era, there has been a surge in the adoption of digital technologies within higher education (Lockee 2021). The integration of distance learning with face-to-face instruction, commonly referred to as blended learning, has been a prevailing trend within many higher education institutions. Geng, Law, and Niu (2019) found that students who were immersed in a blended learning environment exhibited heightened levels of social participation and cooperative interaction within the classroom. Their research underscored the substantial and direct influence of self-directed learning on the students’ cognitive presence within a blended learning milieu. Notably, they posited that students’ technological preparedness exerts a discernible impact on instructional efficacy within integrated learning environments.

Wekerle (2022) endorses the positive influence of digital technologies on student learning within higher education. In particular, this study highlights the efficacy of these technologies when used by educators to stimulate student engagement within constructive and interactive learning activities. Another study by Rashid and Asghar (2016) found that the use of technology fosters self-directed learning and augments student engagement.

The efficacy of using digital tools to support learning in higher education may be enhanced when students actively participate in the selection of tools tailored to their specific learning needs. When attuned to personal learning preferences, digital tools can potentially provide targeted solutions adapted to the unique requirements of each student, thereby fostering a conducive milieu for self-directed learning (Bullock 2013). Damşa (2020) and García-Martínez et al. (2020) underscored the pivotal role of digital tools in configuring students’ learning trajectories and fostering personalized learning environments. Schmid and Dominik (2019) further demonstrated that the integration of digital technologies within personalized learning environments is associated with enhanced self-reported digital skills and a bolstered belief in the utility of digital tools in the learning process. Perera and Gardner (2018) endorsed these findings, revealing a reciprocal interplay between digital literacy and self-regulated learning. Their work suggests that both can potentially be strengthened through the use of personalized digital tools. In synthesis, these studies indicate that students’ active engagement in the selection of digital tools to support their learning endeavors could facilitate self-directed learning, equipping them with the requisite resources and autonomy to sculpt their own learning experiences.

However, inherent challenges and constraints have emerged in the process of harnessing the potential benefits of digital technologies to advance active and self-directed learning. The cultivation of flexible learning and teaching is imperative, and learners must familiarize themselves with diverse tools and navigate the intricacies of technological complexities. Realization of the goals of active and self-directed learning necessitates comprehensive training and continual support, particularly during the process of developing information literacy skills needed for adept navigation of the burgeoning volume of available information (Santos, Batista, and Marques 2019a, 2019b; Aldahdouh, Nokelainen, and Korhonen 2020; Spante et al. 2018).

Despite the widespread adoption of digital technologies by students in higher education, recent studies highlight persistent underutilization of these technologies by educators (Mercader and Gairín 2020). Handerson et al. (2017) explored students’ experiences of using digital technologies. While these authors identified 11 distinct benefits associated with their use, these technologies did not fundamentally transform the nature of university teaching and learning. Other studies have shown that educators tend not to prioritize digital tools for pedagogical purposes, emphasizing the need for extensive pedagogical support to promote digital teaching (Amhag, Hellström, and Stigmar 2019; Pinto and Leite 2020). In one study, faculty members rated learning management systems as the most crucial and efficient digital technology for meeting administrative needs (Martin et al. 2020).

Mercader and Gairín (2020) highlighted pervasive personal, professional, institutional, and contextual barriers impeding educators’ adoption of digital technologies. Of these barriers, professional constraints were reportedly the most prevalent. Perceptions of these barriers significantly influence educators’ engagement with technology. The use of digital tools in a professional context is strongly aligned with educators’ attitudes toward digital technology, which has a more profound impact on the extent to which digital tools are employed compared with digital competence (Madsen, Thorvaldsen, and Archard 2018). During evaluation processes, in particular, educators’ beliefs about learning and technology play a pivotal role in either facilitating or hindering the integration of technology (Romero, Plaza, and Orfali 2019).

The timing of the present study during the academic year 2022–2023 coincided with a strong surge in the integration of digital technologies within Israeli higher education in response to the ramifications of the COVID-19 pandemic. The study’s salience lies in its focused examination of the use of digital technologies for fostering active and self-directed learning. Its objective was to examine techno-pedagogical competencies among college educators for facilitating active and self-directed learning. Additionally, it explored their conceptualizations of self-directed learning using digital technologies to discern their attitudes. The specific research questions were as follows:

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

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

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

**Methodology**

This study employed a comprehensive blended research methodology, encompassing quantitative and qualitative research methods (Creswell and Creswell 2017). The premise underlying the quantitative component of the investigation was that employing a sizable sample enables the extrapolation of findings to larger populations. The qualitative component, conducted in parallel, aimed to elucidate educators’ unique, personal perspectives, thereby eliciting a nuanced understanding of the examined phenomenon.

***The research population***

The research population comprised 156 educators representing diverse academic disciplines across five Israeli teaching colleges. These institutions exhibit distinct profiles: two are sectarian and exclusively serve Jewish cohorts, two are secular and cater to both Jewish and Arab students, and one is dedicated solely to Arab students. Most of the teaching faculty boast substantial teaching tenures, exceeding six years, and deliver a minimum of five courses annually. Table 1 presents a comprehensive overview of the characteristics of the study population, including the distribution of participants by age, sex, academic qualifications, and professional rank and experience.

[Table 1 near here]

***The research tools***

A. *Questionnaire*: A questionnaire with 18 items, designed specifically for this study, was administered online to enable educators to self-assess their familiarity and utilization of digital technologies across a variety of professional contexts. The questionnaire’s design was based on the Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies (SELFIE) framework developed by the European Commission’s Joint Research Center for educators (Kampylis, Punie, and Devine 2015). The SELFIE questionnaire, comprising 34 items, aids educators’ reflections on their digital competence. It provided a foundation for the design of our 18-item instrument, which focused on teaching practices. Areas covered included the creation and modification of digital resources, the use of digital technologies for eliciting feedback and reflection, and enhancing collaboration among learners. Each item was associated with five response options, ranging from non-use to active student involvement, which was aligned with the study’s primary objective.

Additionally, the questionnaire gathered background information on areas such as sex, age, seniority, and teaching field (see the attached questionnaire in the Appendix). The questionnaire was distributed via email to approximately 500 educators, of whom 156 responded, yielding a response rate of approximately 30%.

*B. Semi-structured Interviews:* Ten educators, representing diverse subjects and experiences, were selected in light of their consistent integration of technology within their teaching practice. They participated in semi-structured face-to-face or Zoom-based interviews, each lasting approximately 45 minutes. The interviews aimed to elicit their insights on three key topics: (1) crucial elements for learners engaged in digital learning; (2) a definition of self-directed learning from the interviewee's perspective; and (3) teaching methods and activities that facilitate active and self-directed learning through digital technologies.

***Data analysis***

1. *The questionnaire*: Frequencies were computed for each item and background variable within the study population. Subsequently, factor analysis was performed, using principal axis factoring for extraction and the Promax rotation method to draw correlations between dimensions, particularly non-orthogonal rotation in the presence of multiple dimensions. The results of the factor analysis revealed four distinct dimensions (Table 3), whose interrelations were examined using Pearson's correlation analysis.
2. *The Interviews*: The interview transcripts were thoroughly analyzed, and central themes were identified. The use of content analysis facilitated an exploration of inner experiences, shedding light on the perceptions and actions of the interviewed educators, while also enabling valid conclusions to be derived within a broader context (Krippendorff 2018). For the analysis, two researchers who are the first and second authors of this article individually examined all interview transcripts. They categorized the educators’ responses to each of the three questions posed. The “reliability between judges” framework (Lincoln and Guba 2000) was used for assessing reliability. In cases of discordant opinions, the researchers followed a deliberative process to reach a consensus. The reliability measure was substantial at 88%.

**Findings**

***Areas in which digital technologies are used***

Table 2 summarizes the four domains of use of digital technologies by educators. The most prominent domain was promotion of instructional methods (M=3.63). Many educators created and adapted digital resources for instructional purposes, such as editing text, digital images, and presentations. They utilized cloud-based storage to share information with other educators and used electronic sheets for collecting and analyzing learning outcomes. They also used digital technologies to foster active learning and collaboration among learners (M=3.24). They utilized collaborative files and presentations, WhatsApp forums, digital games, digital portfolios, and more. The third domain, which was less prominent, entailed the use of digital technologies for assessment and feedback (M=3.12), for example, through Google Forms, quizzes, and online surveys. The least utilized digital resources were those that addressed students’ diversity and special needs (M=2.27). Only a small percentage of educators provided digital resources or created tasks with customized levels of difficulty.

[Table 2 near here]

We found that there was a positive correlation between dimensions across the four domains (Table 3). Thus, educators who used digital resources for one purpose, for example, to advance their teaching, also used them for promoting collaborative learning, assessment, and feedback, and addressing diversity among learners. Educators with strong techno-pedagogical skills in one domain also exhibited high levels of proficiency in other areas. The strongest correlation was 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 educators according to their techno-pedagogical levels***

Table 4 shows the distribution of educators according to their techno-pedagogical proficiency in employing digital technologies for specific educational purposes. Our findings revealed that a substantial majority of educators (76.1%) adeptly employed communication tools such as email, online forums, and WhatsApp to facilitate interactions among learners. Equally noteworthy was the significant proportion of educators (66.1%) who used digital platforms to generate educational content, employing media such as presentations and videos. As anticipated, a considerable proportion of educators (approximately 65%) engaged with distance learning technologies, exemplified by the widespread utilization of platforms like Zoom.

Conversely, relatively modest proportions of educators leveraged digital resources to address differences among learners (25.0%), ensure material accessibility (25.5%), and solve pedagogical challenges (32%). These findings underscore a discernible gap in the integration of digital tools for these specific purposes.

Furthermore, a sizable segment of educators was either unacquainted or minimally acquainted with technological tools. For instance, over 30% of educators abstained entirely from using digital tools to provide feedback or conduct assessments, analyze and curate learning materials, foster creative learning through digital games, or problem solving. Remarkably, about 35% of the educators refrained from using Zoom or made sporadic attempts, primarily for distance learning endeavors.

The pivotal insights of this study are encapsulated in the fifth column of Table 4, which shows the prevalence of educators who exhibited the highest techno-pedagogical proficiency. These instructors not only leveraged a diverse array of digital tools but they also actively engaged learners in the selection and utilization of these tools. This collaborative approach fosters self-directed learning and elevates students’ levels of cooperation and active participation. However, relatively few educators cultivated such practices, revealing a discernible disparity compared with those who employed tools without directly involving learners.

For instance, 32% of the respondents reported using digital tools for planning and managing learner activities, but only 17% encouraged their students to make independent choices of digital tools for managing their own educational journeys. This disparity was less pronounced in areas where direct learner involvement was required, such as promoting communication and collaboration among learners or facilitating content creation. In these domains, the divide between educators who involved learners directly and those who did not was less pronounced.

[Table 4 near here]

# ***Analysis of Interviews with Educators***

*Key components of learning in a digital environment*

Table 5 presents a summary of the key components of learning within a digital environment derived from the educators’ responses. The findings of the analysis illuminated their multifaceted perspectives on key technological, pedagogical, and personal components of effective learning in the digital realm.

Technological proficiency stood out as a cornerstone of effective learning, with unanimous agreement among the educators on the need for digital orientation. This orientation entails acquiring mastery over the tools and ensuring their accessibility, availability, and user-friendliness. From a pedagogical perspective, 70% of the educators underscored the heightened significance of group and cooperative learning within the digital landscape. Moreover, a considerable proportion (50%) emphasized the crucial role of continuous feedback and reflection for achieving optimal learning outcomes within a digital environment.

A recurring theme in the educators responses was the critical importance of fostering students’ curiosity and motivation for learning as personal attributes. Almost all the educators emphasized that these intrinsic qualities were essential for learners navigating the digital terrain. Notably, three educators highlighted the importance of instilling critical thinking skills and nurturing a sense of responsibility in students for managing their own learning journey, identifying these factors as key contributors to success within a digital learning environment.

[Table 5 near here]

*Defining self-directed learning*

The educators in this study were asked to define self-directed learning as they perceived it. Ninety percent of the respondents characterized self-directed learning concisely as proficiency in studying independently, navigating information, critically evaluating it, and adeptly organizing and synthesizing it. For example, a chemistry instructor provided the following definition: “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, supporting the claim that independent learning stems from an intrinsic drive that propels the pursuit of learning. As one science educator noted, “self-directed learning is not an obligatory task but an internal engine propelling learning forward.”

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

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

Table 6 presents a synthesis of the educators’ recommendations, which reveal diverse strategies for nurturing active and self-directed learning through digital technologies. Strikingly, 80% of the educators underscored the significance of cooperative learning, entailing collaborative group tasks, leading to the joint production of various artifacts, such as files, presentations, and videos. The educators emphasized the use of the Moodle platform for a variety of functions, such as integrating tasks and creating forums.

Furthermore, half of the educators advocated leveraging smartphones and diverse mobile applications for learning activities 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. A comparable percentage of educators emphasized the importance of continually deploying digital feedback mechanisms. Interestingly, just two teachers expressed the view that providing students with 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 faculty within teaching colleges, focusing specifically on the facilitation of active and self-directed learning. Our investigation explored how and for what purposes digital tools are used by educators. The educators’ primary objective in employing digital tools was to enhance their teaching practices. Studies have found that tools supporting face-to-face instruction, such as presentations, as well as those used for information retrieval and analysis of learners’ products are more readily embraced (Pinto and Carlinda 2020; Mei, Aas, and Medgard 2019).

Our findings, however, revealed limited use of digital resources by educators in addressing disparities among students and accommodating their special needs. Tasks reflecting varying degrees of difficulty and problem-solving tools were underutilized. This finding highlights the need to strengthen the competencies of educators in leveraging open-access digital technologies, thereby fostering inclusivity for all learners.

Our finding of substantial utilization of digital tools to foster active and collaborative learning, including the creation of collaborative files and presentations, WhatsApp forums, and digital games is, however, promising. It highlights the multifaceted role of digital tools and their diverse applications. However, a striking finding was that a limited number of educators involved students in selecting and utilizing these tools. Therefore, the potential for student participation in shaping a constructive and self-directed learning environment requires emphasis.

Popa and Topala (2018) found a positive correlation between students’ self-directed learning and their self-perceptions of advanced digital competencies, which were linked to increased self-efficacy. Rashid and Asghar (2016) claimed that the use of technology positively influences self-directed learning and student engagement, indirectly impacting academic performance. Web 2.0 tools and open-access digital platforms that foster collaboration have been identified as significant predictors of technology-facilitated self-directed learning (Sumuer 2017). Shinkareva (2007) found that a positive relationship existed between instructional technology competency and self-directed learning abilities in adult students. Students who actively engage in selecting digital tools that match 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 educators employed tools that encourage cooperative and active learning, a minority effectively promoted self-directed learning in a digital environment. The positive correlations found between diverse uses of digital tools (Table 3) underscore an association between advanced techno-pedagogical skills and increased promotion of active and self-directed digital learning.

Faculty members within institutions of higher education now have unprecedented levels of access to technology, while also instructing student bodies that are immersed in technology designed for personal use. Nevertheless, our findings revealed a conspicuous discrepancy, with approximately one-third of educators abstaining from the use of digital technology. Furthermore, 20% of educators initiated but then discontinued the integration of digital tools into their teaching practice.

Previous studies have underscored the pervasive issue of partial adoption of digital technology among teachers, exposing gaps in its potential and actual utilization (Polly et al. 2021; Peres, Fernando and Anabela 2017). Significantly, many educators have reportedly failed to leverage digital tools for pedagogical purposes (Amhag, Hellström, and Stigmar 2019; Pinto and Leite 2020).

As noted by Mercader and Gairín (2020), multifaceted barriers are encountered in the process of integrating digital technology within higher education. Foremost among these barriers are professional constraints, which primarily stem from inadequate training and support. Educators who participated in our study also highlighted the need for sustained support and guidance in managing and using technological tools. The temporal demands in acquiring and implementing technological skills coupled with the inherent tension between teaching and other professional obligations, are substantial impediments (Polly et al. 2021). Beyond these issues, there are wider challenges that extend to infrastructure deficits, power outages, and the limited exposure of educators to digital teaching methodologies and training (Liesa-Orús et al. 2020; Dougherty 2015). These constraints collectively obstruct the seamless integration of digital technologies into teaching practices.

Educators’ perceptions regarding the role of digital technologies in education significantly influence their use of these tools. Motivation to use them requires that they recognize the tools’ pedagogical value within their teaching contexts, 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 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 focused on the use of digital tools to encourage cooperative learning.

Strikingly, educators appeared to have a limited perception of self-directed learning, which was widely defined as the capacity to engage independently with study materials. However, in this definition, critical skills of identifying and selecting appropriate learning methods were often discounted. This restrictive viewpoint could explain their lack of emphasis on learners’ involvement in the selection of digital tools.

Educators’ perceptions of self-directed learning reflected a prevalent pedagogical approach characterized by systematic instructor-centered teaching entailing limited flexibility (Mladenovici, et al. 2021). To empower educators to involve learners in the selection of 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 learners’ engagement and sense of responsibility. The challenge lies in equipping educators with the requisite skills, which foregrounds the need to incorporate such training within their own educational frameworks.

**Summary and recommendations**

The present study underscores the prevalent use of digital technologies by educators primarily to enhance the effectiveness of their teaching and foster active and collaborative learning. However, a significant proportion of the surveyed educators did not engage learners in the selection and application of personalized technological tools that are conducive to self-directed learning.

Enhanced techno-pedagogical skills among educators are linked to increased promotion of active and self-directed digital learning. Educators emphasized the critical importance of mastering technological tools as a central aspect of digital learning. Consequently, the provision of ongoing support, guidance, and training to cultivate proficiency in utilizing digital resources is imperative.

Training initiatives should prioritize digital tools that address the diversity of learners, enhance the accessibility of learning materials, and facilitate problem-solving processes. Remarkably, deficits in these skills persist even among educators using technology for other purposes.

Educators identified group assignments and the collaborative creation of digital products as the most effective activities for promoting self-directed learning in a digital context. Nevertheless, their perceptions of self-directed learning tended to be superficial and inattentive to learners’ participation in choosing and adapting learning methods. To empower educators to promote self-directed learning, targeted training programs that emphasize flexible teaching approaches and prioritize students’ involvement in the selection of learning methods are essential.

Despite an increasing trend of digital tool adoption, a significant proportion of educators continue to abstain from incorporating digital resources into their teaching practices. Recognizing and addressing the reasons behind this reluctance, including potential fears or reservations about technology, is crucial. Investigating the experiences of educators who attempted to use digital tools but did not persist in their efforts may reveal valuable insights and guide the formulation of effective solutions.

**Research limitations**

This study had two significant limitations. First, reliance on educators’ self-reporting introduced a potential limitation, as it is unclear whether their reporting accurately depicted their practices. Augmenting the methodology with additional tools, such as direct observations, or monitoring of learning outcomes would enhance the depth and accuracy of the study’s findings. Second, the diversity of the participants’ knowledge fields and course characteristics introduced variability that could have impacted the findings. Challenges resulting from such variability, observed, for example, at workshops and in theoretical courses, have been reported in the literature (Aldahdouh, Nokelainen, and Korhonen 2020; Záhorec, Nagyová, and Hašková 2019). To address these limitations, we propose to conduct a follow-up study to investigate potential disparities in techno-pedagogical skills among educators that relate to background variables, such as knowledge fields, the nature of courses, gender, and seniority. This follow-up study would aim to contribute valuable insights that could advance effective use of digital technologies among educators, thereby fostering active and self-directed learning practices.

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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.