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Integrating direct instruction methods

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Abstract

This study investigates the effectiveness of integrating Direct Instruction (DI) methods into the teaching of computer skills within the context of a Palestinian university. DI is a structured, evidence-based teaching model designed to promote mastery through scripted lessons, scaffolded support, and continuous assessment. Although DI has demonstrated strong outcomes in general and special education contexts, its application in computer literacy instruction, particularly in Arabic-speaking, resource-limited settings, remains underexplored. This quasi-experimental study compares the learning gains of two groups of undergraduate students: one receiving DI-based instruction and the other taught using conventional learner-centred methods. Over six weeks, students in the DI group engaged in highly structured lessons targeting file management, word processing, and safe internet practices. Results from pre- and post-tests reveal that the DI group achieved significantly higher gains, with extremely large effect sizes across all measures. The findings suggest that DI offers a viable, pedagogically sound alternative to conventional teaching approaches in skill-based courses where structure, mastery, and assessment-driven instruction are prioritised. The study also considers the potential benefits of integrating collaborative learning strategies to complement DI's structured format and promote learner engagement. Recommendations are provided for curriculum designers, ICT instructors, and policymakers seeking to improve digital competence outcomes in comparable educational contexts.

Introduction

Computer skills training in higher education has become increasingly necessary, particularly in the regions where the learners may have little prior experience with information technology. For university students in Palestine, the privilege of access to the academic study and working life information technology demands often remains unavailable as a consequence of gaps in initial computer education, infrastructure deficiencies, and uneven pedagogy. Such issues are themselves rendered worse by study sequences which lack coherence and evidence-based pedagogy. Direct Instruction (DI) models, as a result, are gaining attention as a way of introducing incremental, measurable increments in core skills such as file management, word processing, and internet security.

DI is a systematised instructions method with origins in behaviourist learning theory and cognitive task analysis. Originally created to aid heterogeneous learners in the mastery of academic material, DI has been commonly used in mathematics, reading, and vocational education (Rolf, 2021; Slocum & Rolf, 2021). DI fosters mastery through such strategies as scripted instruction, scaffolding, regular checks for understanding, and correction of errors. In contrast to exploratory strategies or discovery, DI focuses on teacher-directed instruction, chorused responses, and a standardised format for instruction. Its ability to aid the acquisition of digital skills, particularly in settings wherein students require defined expectations and directed practice, makes a second look worthwhile. Conventionally, instruction for computer skills at most universities depends upon student self-exploration, peer-to-peer work, and problem-based exercise activities. Although such strategies promote individual freedom and activity, they are not particularly helpful for students without prior knowledge of the digital area nor are they effective when repeated, structured coverage of core skills are required. Moreover, in systems where assessment outcomes are critical, such as the Palestinian higher education context, unstructured instructional approaches may fail to deliver consistent results across diverse student groups.

This study explores whether DI can address these challenges by providing a more structured and mastery-oriented alternative. Specifically, it investigates whether DI leads to greater learning gains in digital competence compared to conventional instructional methods. Through a quasi-experimental pre-test–post-test design involving two intact classes, the study targets foundational computer skills as a test case for applying DI in general university teaching. It also considers the potential for enhancing DI with collaborative or interactive elements to improve student motivation and engagement. The findings contribute to broader discussions about pedagogical reform in skill-based university education and offer practical insights for improving digital literacy instruction in similar settings.

Literature review

Integrating Direct Instruction (DI) methods into computer skills education represents a promising strategy to address the diverse needs of learners, particularly in contexts like Palestine, where digital competence is increasingly vital amid sociopolitical constraints, evolving educational standards, and limited classroom technology. This review draws on two major bodies of literature: (1) the design and implementation features of DI, and (2) learner-centred approaches to computer skills instruction. Together, these literatures illuminate opportunities and limitations for applying DI in skill-based instruction and inform pedagogical decisions in Palestinian university classrooms. DI is a highly structured, research-based instructional model originally developed to deliver challenging academic content to both typically developing learners and those with special educational needs (Rolf, 2021). Central to DI is the principle that teaching must be systematically designed and explicitly delivered through clear formats, consistent teacher–student interactions, and data-informed adjustments. As Slocum and Rolf (2021) explain, DI begins with rigorous content analysis to isolate powerful generative concepts, followed by the development of logically sequenced lessons (Watkins & Slocum, 2004). Johnson (2021) underscores the importance of using examples and nonexamples to define concept boundaries, while Twyman (2021) highlights faultless communication through carefully juxtaposed input to ensure only one valid interpretation.

Instructional formats in DI are highly scripted exchanges that guide both teacher delivery and student responses (Rolf, 2021). These formats aim to minimise ambiguity, which is particularly beneficial in ICT instruction, where unfamiliar terminology and multi-step procedures often overwhelm novice learners. For example, DI replaces abstract explanations of software functions with clear, explicit cues such as “Click here, then press Enter to open the file” to support sequential understanding. Scaffolded learning is embedded in every DI lesson, with teacher support gradually withdrawn as learners demonstrate mastery. This gradual release model enables students to develop fluency and autonomy over time in applying essential computer operations. DI also employs flexible, skills-based grouping and placement assessments to align instruction with learners’ current ability levels. Teachers make real-time and long-term decisions based on student performance, using mastery checks every few sessions to guide instructional pacing and intervention (Rolf, 2021, pp. 798–799). Unison group responding, a hallmark of DI, ensures active participation and enables instructors to monitor learner progress collectively. These features, coupled with structured error correction and tightly managed pacing, make DI highly adaptable to mixed-ability classrooms, such as those found in many Palestinian universities, where digital literacy levels vary significantly.

In contrast to DI’s structured nature, learner-centred approaches to teaching computer skills prioritise exploratory learning, project-based activities, and peer collaboration. These methods,

rooted in constructivist pedagogy, argue that students learn best when they actively construct knowledge through real-world tasks and problem-solving (Jonassen, 1999; Alaofi, 2020). In such classrooms, students might work in pairs to create presentations, troubleshoot errors, or explore unfamiliar software interfaces. These approaches promote autonomy, creativity, and critical thinking, key attributes in modern digital environments (Allwood, 2011; Amin, 2019). However, several studies have highlighted limitations of learner-centred models, especially when applied without sufficient scaffolding or in low-resource environments. As a result of weak foundations in the antecedent use of computer facilities, these students may have problems working on open-ended activities without explicit guidance (Graesser et al., 2021; Mudinillah et al., 2024). Furthermore, such approaches very seldom have inherent rewards for daily mastery of the rudimentary skills, such as file exploration, formatting, or spread sheet manipulation, needed in classroom as well as working life practice. Under exam-based systems like the Palestinian ones, where the assessing parameters need practical skills, the exploratory method as such may not adequately prepare the learners. While learner-centred strategies promote freedom, DI complements them by offering structured design of instruction, teacher guidance, and data-driven testing software. For these reasons, DI lends itself extraordinarily well to core courses for computer literacy, aiming to build consistent mastery in a heterogeneous population. Moreover, the advantage of DI does not reside in avoiding flexibility, but rather, in supporting teachers with a system that facilitates adaptive delivery. Under DI, the teacher does not circulate as a script-reading lecturer, but as an adaptive guide, changing pace, tone, and emphasis of material as a function of students' real-time needs (Rolf, 2021, p. 797). Similarly, project-oriented strategies depend critically upon the teacher's ability to guide learners through lengthy, often murky tasks (Ali, 2020).

Current gaps in the literature suggest the need for blending structured, teacher-posed models like DI, for example, with open, learner-engage approaches to improve their instructional benefits. Integrative synthesis could potentially benefit both approaches while avoiding their shortcomings. For example, DI's scripting and mastery-based progression can ensure that learners develop core competencies, such as formatting a document or organising digital folders, while project-based activities can provide contexts for applying these skills creatively and collaboratively (Golfetto, 2020). In Palestine's monolingual Arabic context, where many students enter university with limited formal ICT training, integrating DI with collaborative and task-based methods may offer a context-sensitive and pedagogically balanced solution. Nevertheless, further research is needed to examine how these methods can be effectively localised. Longitudinal studies on the sustainability of DI in digital skills instruction, especially in non-Western, assessment-driven systems, remain limited. Likewise, little is known about how DI influences learner motivation and digital confidence compared to exploratory or gamified instructional models (González-Lloret, 2020; Hidden, 2020). Future work should explore

how structured instruction can be paired with opportunities for creative application, ensuring that students not only master core competencies but also develop the adaptability required for evolving technological landscapes.

RQ1: To what extent does Direct Instruction improve digital proficiency among Palestinian university students compared to traditional teaching methods?

RQ2: To what extent does Direct Instruction produce greater learning gains in computer skills than conventional instruction?

Methodology

Participants

The study involved a total of 30 undergraduate students from a public university in the West Bank, Palestine. Participants were second-year students, aged between 19 and 21 years, enrolled in a compulsory computer skills course. All students were native Arabic speakers with varied prior exposure to digital technologies, learning in a monolingual Arabic-speaking environment. Two intact classes were selected for the study and assigned to the experimental group and control group, each comprising 15 students. Selection was based on previous academic performance in ICT-related courses to ensure both groups had comparable levels of digital competence. None of the students had previously been exposed to Direct Instruction (DI) or similar scripted instructional approaches. The teacher involved in this study was university-level ICT lecturers with at least five years of lecturing practice. The teacher of the experimental group was given a two-week course of study on the concepts and pedagogy of DI prior to the use of the program.

Procedure

This intervention extended over a period of six weeks and comprised 12 sessions total, with 90 minutes as the approximate duration of each session. Direct Instruction, a model specifically planned for the instruction of basic computer skills, was used to teach the experimental group. Lessons were delivered using carefully scripted materials that emphasised precision, sequencing, and consistency. Instruction followed a structured format, involving clear teacher prompts, unison oral responses where applicable, repeated practice of skills, and immediate correction of errors. Lessons incorporated scaffolded learning, gradually reducing teacher support as students demonstrated mastery. Mastery checks were administered after every fourth lesson to guide instructional pacing and identify areas needing reinforcement. Instructional content was aligned with the university's

ICT course outcomes but adapted using DI techniques, including the use of examples and nonexamples to clarify software operations, safety procedures, and task steps (e.g., saving files, formatting documents, identifying phishing links). In contrast, the control group received instruction based on conventional student-centred methods commonly used in ICT instruction. These lessons included exploratory learning, project work, group discussions, and peer assistance but lacked scripted input, systematic mastery checks, or scaffolded progression.

Research design

This study employed a quasi-experimental pre-test–post-test control group design to explore the effectiveness of Direct Instruction in improving students' digital proficiency. As random allocation was not feasible due to scheduling constraints, intact classes were assigned to each group. This design enabled the comparison of learning outcomes while maintaining ecological validity in a real university classroom setting. The intervention targeted three core areas of digital competence: file management, word processing, and internet safety.

Data analysis

All participants completed a pre-test and a post-test consisting of 40 items that assessed their skills in file operations, text formatting, and safe browsing practices. The test was adapted from existing ICT proficiency assessments commonly used in Palestinian universities and was piloted with a comparable group of students, yielding a Cronbach's alpha of .89. Gain scores were computed by subtracting each student's pre-test score from their post-test score. Independent samples t-tests were conducted using SPSS version 29 to determine whether there was a statistically significant difference between the two groups' gain scores. Levene's Test for Equality of Variances confirmed homogeneity of variances, allowing for standard t-test interpretation. The results indicated a statistically significant difference favouring the experimental group. To evaluate the practical significance of the results, effect sizes were calculated using Cohen's d, Hedges' g, and Glass's delta, all of which showed extremely large effects, highlighting the strong learning gains associated with DI in teaching computer skills.

Ethical considerations

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the university in Palestine. Written informed consent was secured from all participants. Students were informed of the study's purpose, procedures, and their right to withdraw at any time without academic penalty. Confidentiality and anonymity were ensured throughout, with all data managed

in accordance with institutional ethics guidelines. No incentives were provided. A debriefing session was held at the end of the intervention to clarify the research process and address student questions.

Results

Table 1

Group Statistics

	Group_Code	N	Mean	Std. Deviation	Std. Error Mean
GainScore	1	15	15.40	3.019	.779
	2	15	5.00	2.104	.543

The data presented in *Table 1* demonstrates a substantial difference in the mean gain scores between the experimental group (Group 1), which received direct instruction, and the control group (Group 2), which did not. Specifically, the experimental group recorded a mean gain score of 15.40 (SD = 3.02), while the control group scored only 5.00 (SD = 2.10). The difference of over 10 points clearly suggests that direct instruction had a noteworthy influence on student performance. Moreover, the relatively smaller standard deviation within both groups indicates that the participants' responses were fairly consistent, with the experimental group also showing a higher standard error mean (0.779) than the control group (0.543), likely due to the higher variance in gains brought about by the intervention.

Table 2

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
GainScore	Equal variances assumed	1.606	.216	10.945	28	.000	10.400	.950	8.454	12.346
	Equal variances not assumed			10.945	25.006	.000	10.400	.950	8.443	12.357

Moving on to Table 2, the independent samples t-test further supports the statistical significance of the observed difference between the two groups. The Levene's Test for Equality of Variances returned a non-significant result ($F = 1.606$, $p = .216$), suggesting that the assumption of equal variances can be met. This justifies the use of the first row of the t-test, which shows a highly significant result ($t(28) = 10.945$, $p < .001$), indicating that the mean difference of 10.40 between groups is unlikely to be due to chance. The 95% confidence interval for the mean difference, ranging from 8.454 to 12.346, does not cross zero and further reinforces the statistical reliability of this finding. These results robustly affirm that students exposed to direct instruction methods exhibited significantly greater improvement than their counterparts in the control group.

Table 3

Independent Samples Effect Sizes

				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
GainScore	Cohen's d	2.602	3.997	2.721	5.248
	Hedges' correction	2.675	3.888	2.647	5.106
	Glass's delta	2.104	4.942	2.984	6.876

a. The denominator used in estimating the effect sizes.
Cohen's d uses the pooled standard deviation.
Hedges' correction uses the pooled standard deviation, plus a correction factor.
Glass's delta uses the sample standard deviation of the control group.

Table 3 presents the effect size estimates, which quantify the magnitude of the intervention's influence. All three measures, Cohen's d, Hedges' g, and Glass's delta, indicate extremely large effects, with point estimates of 2.602, 2.675, and 2.104, respectively. According to Cohen's conventions (Cohen, 1988), an effect size above 0.8 is considered large; thus, values above 2.0 point to an exceptionally strong educational benefit. The confidence intervals for these estimates are also well above conventional benchmarks, with Cohen's d ranging from 2.721 to 5.248, indicating the consistency and precision of the estimated effect. Notably, the highest interval values appear with Glass's delta, which uses the standard deviation of the control group, suggesting that the intervention had a particularly stark advantage compared to the variability within the non-instructed students. Taken together, the findings across the three tables provide compelling evidence that integrating direct instruction methods significantly enhances student outcomes, with both statistically and educationally meaningful effects.

Discussion

The findings of this study offer compelling empirical support for the integration of Direct Instruction (DI) methods in teaching computer skills at the tertiary level in Palestine. The experimental group's significantly higher gain scores compared to the control group confirm the practical effectiveness of DI in improving digital proficiency. These results also suggest that DI can address instructional challenges in resource-constrained and exam-oriented environments, especially where structured learning, measurable outcomes, and teacher-led delivery are valued. This discussion explores the implications of these findings, drawing on the theoretical and empirical literature discussed earlier, and situates them within broader debates on skill-based pedagogy, teacher agency, and instructional design in non-Western university settings.

Revisiting the promise of DI in ICT education

The statistically and educationally meaningful gains observed in this study reinforce prior research asserting that DI, when implemented with fidelity, produces accelerated and consistent learning outcomes (Rolf, 2021; Watkins & Slocum, 2004). In Palestinian classrooms, where computer instruction is often fragmented or delivered through loosely structured lab sessions, DI's systematic approach provides the clarity and progression necessary for mastering technical tasks. The extremely large effect sizes recorded in this study suggest that DI not only improves performance incrementally but reshapes learners' skill acquisition trajectories in a marked and sustained way. As Slocum and Rolf (2021) argue, one of DI's core strengths is its clear sequencing and explicitness, features that were built into this study's lesson designs. Unlike conventional ICT teaching, which frequently relies on exploratory or trial-and-error learning, DI ensures procedural coherence through scripting, repetition, and mastery checks. For students with limited prior exposure to digital environments, this structure closes the gap between exposure and retention, addressing the uneven digital preparedness that characterises many university cohorts in Palestine.

Structured instruction meets localised needs

The findings align with the instructional principles outlined by Johnson (2021) and Twyman (2021), particularly DI's emphasis on concept boundaries, use of examples and nonexamples, and tightly controlled teacher–student exchanges. In the ICT classroom, learners have to navigate abstract interfaces, interpret icons, and execute multi-step commands, and clarity and practice in a structured

way are required. For these DI sessions, the study avoided use of technical terms and opted for operational descriptions, e.g., “Click here to format text” rather than assuming the student already knew a meaning for terms like “alignment” or “font size.” The research further substantiates the compatibility of DI with the course structure of university-level computer skills courses, which often emphasise mastery of activities such as file management, use of a word processor, and safe browsing, points at which DI excels through the cumulative lessons and controlled feedback. Additionally, the flexible group work and the common use of the formative assessments inherent to DI enable teachers to adapt instruction for mixed-ability classes, a central feature common to Palestinian universities where the availability of technology and the pre-existence of knowledge may vary considerably.

Integrating DI with exploratory and collaborative methods

Although this study focused on DI, the literature suggests that learner-centred and project-based methods commonly used in ICT education can complement DI’s structured approach (Alaofi, 2020; Allwood, 2011). The need for such integration is supported by critiques that DI, on its own, may not adequately support creativity, collaboration, or real-world application, key outcomes in modern digital literacy education (Graesser et al., 2021; Mudinillah et al., 2024). Bringing DI into dialogue with more exploratory practices does not require abandoning structure. Rather, as Johnson and Street (2004) explain, effective DI delivery remains flexible and responsive. Teachers can maintain scripting for foundational tasks while integrating structured application projects that allow students to extend their knowledge in meaningful ways. For example, after a DI lesson on spreadsheet formatting, students could complete a short collaborative task where they analyse data or create a simple budget, thus reinforcing learned procedures through authentic practice.

Teacher agency and professional development

The results of this study must also be understood in relation to teacher agency. DI demands that instructors engage in detailed planning, formative assessment, and real-time adjustments, all of which require targeted training and support. While the two-week training given to the experimental group’s instructor proved adequate for implementation, this may not generalise to all instructors, particularly those more accustomed to learner-led, improvisational methods. Rolf (2021) notes that the DI teacher is not a script follower but a facilitator who adjusts delivery based on students’

responses. This has important implications for professional development. Instructors must be equipped not only with DI routines and materials but also with strategies for diagnosing student needs, pacing content delivery, and maintaining motivation. In the Palestinian context, where ICT educators often lack access to ongoing pedagogical training, university departments should consider investing in modular, practice-based training programmes focused on structured teaching approaches.

Motivation, engagement, and learner experience

Although the current study did not collect qualitative data on student attitudes, the literature suggests that DI's structure may have mixed effects on motivation depending on the learner profile and delivery quality (González-Lloret, 2020; Hidden, 2020). In contexts where students are familiar with teacher-centred learning, the explicitness and clarity of DI can be reassuring. However, without variation and interactivity, DI may be perceived as repetitive or monotonous by learners who prefer autonomy and creativity. As Golfetto (2020) found, students in digital skills courses expressed higher engagement when lessons incorporated both step-by-step guidance and opportunities for application. In this light, Palestinian instructors might consider interleaving DI with exploratory segments, such as troubleshooting challenges, mini-projects, or gamified review activities. These could serve both motivational and pedagogical functions, ensuring that core procedural skills taught via DI are reinforced through practical application.

Broader pedagogical and curricular implications

The study's findings also carry implications for curriculum design and instructional planning in university-level ICT programmes. Many computer skills courses follow a checklist model, requiring students to complete isolated tasks with minimal coherence between lessons. Integrating DI principles such as cumulative content sequencing, scaffolded support, and mastery-based pacing could dramatically improve outcomes in such settings. Doing so would also respond to employers' increasing demands for digitally competent graduates with task fluency and reliability. The study also raises broader questions about adapting Western pedagogical models to local contexts. While DI has its origins in American behavioural and cognitive psychology, its structure proved highly compatible with the instructional expectations of Palestinian students. This highlights the

adaptability of DI when appropriately localised, especially in educational systems that value standardisation, progress tracking, and teacher-led instruction.

Limitations and directions for future research

Several limitations should be acknowledged. First, the study's small sample size and relatively short duration (six weeks) limit generalisability. Longer-term interventions are needed to assess whether DI's benefits are sustained over time and how they influence students' real-world use of digital tools in academic and professional settings. Second, the study focused on three domains of digital competence: file management, word processing, and internet safety. Future research could explore whether DI is equally effective in teaching more complex or conceptual topics in ICT, such as data analysis, cybersecurity awareness, or programming logic. Third, the study did not collect qualitative data on learner attitudes or experiences. Understanding how students perceive DI, whether it increases their confidence, reduces anxiety, or limits their creativity, would offer valuable insights for designing balanced, student-centred instruction. Gathering such feedback could help refine hybrid approaches that combine DI with problem-solving or collaborative learning. Finally, future studies should investigate the effectiveness of blended models that combine DI's precision with the open-ended tasks typical of constructivist ICT instruction. Mixed-method research, including classroom observations, student interviews, and longitudinal assessments, could help identify optimal ways to merge structure with flexibility in digital skills education.

Conclusion

This work demonstrates that the integration of Direct Instruction as a mode of computer skill instruction can produce significant, objectively monitored increments in student achievement, particularly in central areas like file management, text formatting, and online safety. Direct Instruction's use of-scripting, scaffolding, and responding to tests directly negates the fragmentation that is a hallmark of split ICT provision. Due to the use of mastery and clarity, it lends itself moreover particularly to beginners used to working in exam-centred, resource-poor conditions. At the same time, the study calls for judicious combination of DI with student-centred approaches to promote application, cooperation, and higher-level thinking. Rather than positing the structure and exploration as mutually exclusive, a combination can have the strengths of both: ensuring core competencies while allowing room for creativity and motivation. As the demands for digitally

literate university graduates continue to grow, and as education systems continue to strive to balance efficiency and fairness, formal models like DI, when contextualised and supplemented, could offer a transformation pathway for the development of digital literacy with diverse learner groups in Palestine and beyond.

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Conflict of interest

The author declares that there are no conflicts of interest related to the execution or reporting of this research.

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