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THE IMPACT OF ADAPTIVE NAVIGATION DESIGN (LINK HIDING, DIRECT ROUTING) ACCORDING TO THE COGNITIVE STYLE (INDEPENDENCE-DEPENDENCE) ON THE COGNITIVE DOMAIN IN THE E-LEARNING ENVIRONMENT ON REDUCING DIGITAL STRESS AND USABILITY AMONG EDUCATIONAL TECHNOLOGY STUDENTS

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ABSTRACT

The current research aims to study the effect of different adaptive navigation methods (link hiding - direct routing) and cognitive style on the perceptual domain (independence - dependence) in reducing digital stress and increasing students' Usability the e-learning environment. Therefore, an electronic learning environment was applied to the research sample, which consisted of (80) first-year students from the Department of Educational Technology and Computer Science at the Faculty of Specific Education, Kafr El-Sheikh University. They were distributed into four main groups, each group consisting of (20) students. A group that uses adaptive navigation techniques (hiding links) and the cognitive style (independence), a group that uses adaptive navigation techniques (direct routing) and the cognitive style (independence) , a group uses adaptive navigation techniques (link hiding) and the cognitive approach (dependency), while another group uses adaptive navigation techniques (direct routing) and the cognitive approach (dependency) when using electronic tests, according to the variables of the current research. The Digital Stress Reduction and Acceptance Scale was administered to the research sample of students post-tested, and the results indicated that using adaptive navigation methods (direct routing) with the cognitive style (independence) in the e-learning environment reduces digital stress among students, while also fostering interaction between them, And Using adaptive navigation techniques (hiding links) with the cognitive style (independence) increases student acceptance of the use, with no interaction between them.

KEYWORDS: E-Learning Environment, Adaptive Navigation Techniques, Cognitive Style, Digital Stress, Usability.

1. INTRODUCTION

As a result of the amazing and rapid development in digital transformation technologies within Egypt's Vision 2030, educational institutions are paying increasing attention to the application of educational websites and adaptive digital platforms, and exploring different methods of navigation and interaction within these environments. With the increasing volume of digital educational content and the complexity of educational resources, the need has arisen to design user-friendly and flexible interfaces that allow learners to access information quickly and efficiently, taking into account their different learning styles and levels of digital experience. Focusing on navigation strategies such as direct routing and hidden links has also become essential to ensure reduced digital stress, improved user experience, and enhanced acceptance of educational platforms and continuity of self-learning.

Digital educational websites are among the most prominent modern technological tools that support learning processes, and the acceptance of using these websites is a key indicator of the success of the e-learning process, as it reflects the learner's readiness to use the website and their continued engagement with it based on their understanding of its usefulness and ease of use.) Alshehri, M., Drew, S., & Alhussain, T. ,2012). Usability is affected by several design and cognitive factors, most notably the site's navigation methods, which can make it easier for learners to access the required content and reduce cognitive load, thus contributing to reducing digital stress and increasing the level of usability.)Tracy, J. P., & Albers, M. J. ,2006). Conversely, the lack of appropriate navigation methods can increase the effort required to locate the desired information, raising digital fatigue levels and negatively impacting user engagement with the educational website. Therefore, the design of navigation methods within educational websites is crucial for enhancing and improving the learning experience.(Shanthi, A et al., 2025).

The importance of adaptive navigation techniques can be highlighted through the following points: (1)Reducing unnecessary paths: Adaptive navigation techniques help guide the learner towards links that suit their cognitive level and learning style, thus reducing learner distraction and making the process of accessing information more efficient.(2) Supporting the achievement of learning objectives: These methods rely on the data available in the learner model to provide customized learning paths that help them achieve their learning objectives effectively. .(Halizah & Gede Pramudya, 2014)

Adaptive navigation relies on several key mechanisms, most notably: (1) Hiding and showing links, as this method contributes to controlling the amount of information displayed during navigation in order to reduce the learner's cognitive overload.)2) Annotating links by adding notes or visual cues to hyperlinks to provide the learner with information that helps them understand the link's content before selecting it. (3) Arranging links in a way that aligns with the learner's learning style, thus facilitating access to information. (4) Direct routing, which is one of the simplest methods of adaptive navigation, provides the learner with directions to the next best link to visit. (5) Adaptive maps, which present the learner with a map representing the general structure of hyperlinks between components of the educational content.) Martin, Hammond et al. ,2016)

The study by Turcine & Kapusta ,Munk, 2009), which aimed to conduct an experimental comparison between the adaptive linking comments method and the direct guidance method within the Moodle learning management system, indicated the importance and effectiveness of direct routing in the e-learning environment, as it was shown to be more efficient in supporting student learning compared to the other method.

In this regard, the study by Hasio et al. (2021) pointed to the importance of using the direct routing method in guiding the learner towards the most appropriate question during personal assessment tests, which enhances the effectiveness of the assessment and its suitability to the learner's level and cognitive style.

However, it is best to use the navigation method of hiding links when dealing with long text pages, such as blog posts or educational content pages. Hiding links is an effective navigation tool that helps users move quickly between different sections of the page.)Vlasenko, K., Volkov, S., Sitak, I., & Bobyliev, D,2020).

According to)Fang, X., & Holsapple, C. W. ,2011)., hidden links provide a smoother browsing experience, as they reduce the time spent searching for information, increase learning efficiency, and enhance user satisfaction with the site in general.

Learners' cognitive styles (field-independent/field-dependent) play a crucial role in the design of educational websites, as they determine how individuals respond to different guidance styles. Field-independent learners are better able to benefit from direct routing.)Palmquist, R. A., & Kim, K. S. ,2000), This reduces their digital stress and helps them freely control their learning path and explore content according to their own plans. On the contrary, field-dependent learners need clear

guidance and direct links to facilitate access to information and reduce cognitive load, and are more sensitive to the absence of navigation elements or the hiding of links, which may increase their digital stress, which in turn may affect their acceptance of using the site.)Zhang, J. ,2023).

The acceptance of educational websites is linked to the learner's cognitive style, as field-independent individuals tend to accept websites that give them freedom of exploration and self-control in their learning path. While field-dependent individuals prefer sites that provide clear guidance and direct links to facilitate access to content and reduce cognitive load.) El Sabagh, H. A.,2021). In this context, cognitive style acts as a moderating variable, influencing the strength of the relationship between website design and the reduction of digital stress or increased usability. The alignment of website design with the learner's cognitive needs enhances the learning experience and reduces levels of digital stress. (Ismail, H., Khelifi, A., & Harous, S. ,2022)

Researchers agree that there is a relationship between cognitive learning styles, digital stress, and acceptance of using educational websites, as learners' cognitive style affects how they interact with website elements and their ability to control their learning path.)Gunesekera, A. I., Bao, Y., & Kibelloh, M,2019). In this context, navigation methods represent a key strategy that enables the student to move around the educational site flexibly, as they help him determine his current location and guide his next steps according to his cognitive learning style.)Alshehri, A., Rutter, M., & Smith, S. ,2023) Therefore, it becomes necessary to take these differences into account when designing the educational website to ensure the reduction of digital stress, the enhancement of the learning experience, and the increase of user acceptance of the educational platform.

Based on the above, the learners' cognitive style plays an important role in determining the student's choice of navigation method or preferred browsing link within the educational website.)Katsaris, I., & Vidakis, N. ,2021), Therefore, when designing an adaptive e-learning environment, the cognitive styles of each learner must be taken into account, as this is a key factor in designing and building educational content in a way that ensures accessibility, reduces digital stress, and enhances user acceptance of the educational platform.)El Sabagh, H. A. ,2021).

Accordingly, an integrated relationship can be envisioned between search variables, where navigation methods within educational websites, such as direct routing and link hiding, affect the level of digital stress among learners. This, in turn, influences the acceptance of using educational websites. In this context, learners' cognitive style acts as a moderating variable, affecting the strength and direction of these relationships. This framework allows us to understand how to design educational websites in a way that takes into account the individual differences between learners, which contributes to reducing digital stress, promoting acceptance, and achieving effective use of e-learning.

Therefore, it is necessary to study the relationship between the adaptive navigation style (Direct routing - Link hiding) on educational websites and the cognitive learning style (independent - dependent) on the cognitive field and to measure the effect of this on reducing digital stress and acceptance of use among educational technology students.

2. THEORETICAL FRAMEWORK

The current study attempts to investigate the relationship between the adaptive navigation style (Direct routing - Link hiding) on educational websites and the cognitive learning style (independent - dependent) on the cognitive field, and to measure the effect of this on reducing digital stress and acceptance of use among educational technology students. Therefore, the theoretical framework of this research comes in three main themes as follows:

2.1. The First Theme: Educational Website Design

A website is a place on the internet that contains pages and digital files linked to each other that a user can visit to read information, view content, or perform services such as shopping, learning, or communicating, so it is important that it has a design that attracts users.)Broeder, Peter, & Gkogka, Anna. ,2020) Website navigation is a crucial part of web design, as it contributes to improving the user experience. Understanding website navigation can help users access the information they need as quickly as possible through a user-friendly and enjoyable design, while also increasing ease of use. (Parlakkılıç, A., & Yıldırım, Ö.,2021).

A well-designed educational website serves as an ideal tool for institutions and educational platforms to showcase their offerings and attract prospective students. Outstanding educational websites are multifunctional: they host self-paced courses, provide detailed information about curricula, offer a variety of learning resources, and much more. But how can one design a successful educational website, and what are the essential features it should include? (Shanthi, V., Ramayah, T., & F. Aguirre ,2025).

An educational website serves as a comprehensive, interactive platform offering diverse information to various user groups, such as prospective and current students, teachers, parents, individuals seeking career changes, and others. All sections of the website must be well-organized and structured to ensure that the required content can be easily found and accessed quickly. (Irfan, L., Jadoon, N. K., & Islam, F. ,2025).

Designing educational websites is not just about appearance; it also encompasses the overall user experience and the feeling users get while navigating the site. (Ortíz O., et al., 2024) Below are some key features that can help you understand general trends in educational websites and identify the areas to focus on when designing. (Memon, N. A et al., 2025). These design aspects can be summarized as follows:

Appearance: The appearance includes the website design, colors, images, and fonts used in creating educational websites. All these elements must be considered when designing a website, as they significantly contribute to the user's first impression and enhance their overall experience. (Jongmans, E.et al ., 2022)

Authentication Page and User Profiles: It is essential to provide users with a login option using email or phone number and password. Student and teacher profiles should be separate, each containing features appropriate to its role. Students need access to a list of current and completed courses, as well as detailed information about degrees, credits, and units. Instructors, on the other hand, require a page displaying their academic information and a list of the courses they have added. (Rosário, A. T., & Dias, J. C. ,2022)

Dashboard: The dashboard is an essential part of the educational website, providing users with a comprehensive overview of their activities and performance. The dashboard should display information for students such as current and completed courses, study progress, earned certificates, the number of courses enrolled, and the number of available credit hours. For teachers, their dashboard should include a list of the courses and programs they have managed, the ability to track student assessments, and statistics related to learning performance. A clear and organized dashboard design allows teachers to access important information quickly and efficiently. (Masiello, I.,et al ., 2024).

Content management system : A content management system (CMS) is a vital component of educational platforms, impacting search engine optimization (SEO), website performance, and popularity.(Narayan, A.et al ., 2025) It must be user-friendly for both administrators and users, enabling quick and efficient updates to materials, especially in large educational institutions with a significant number of users. (Sharma, G., et al., 2022).

The Right Message: Every educational website aims to convey the right message to its visitors, as users seek assurance that the site is reliable and meets their expectations. A website is a key tool for enhancing an organization's image and building its brand. (Trissetianto, A. C., Cahyono, D. T., & Miharja, J. ,2025).

Professional designers emphasize that a school website's design must be based on the institution's core mission. This focus should be evident in all aspects of the site, from color choices to functionality and features. Alignment with the mission ensures a user-friendly interface, provides features that precisely meet the needs of all users, and enhances the overall user experience. (Hyun, H., & Marsden, J. ,2024).

Navigation: The navigation tools included on the page are the primary and easiest way to facilitate site navigation. These tools should be simple and clear, with a limited number of options, and should include calls to action, especially when navigating to pages such as "Apply" and "View Programs/Courses." (Shanthi, A., Zainal Abedin, N. F., & Paramasivam, S. ,2025).

Good navigation acts as a guide for the user, as visitors don't always know what to do next. Therefore, it's essential to provide clear options to avoid confusion, since difficult navigation can lead to users leaving the site and seeking alternatives. (Roshan, H., & Ahmadi, P. ,2022).

2.2. The Second Theme : Navigation Methods In Educational Websites

Navigation is a visual presentation tool designed to illustrate learning paths and how learners interact with content, as well as to define the characteristics of the activity and its alternatives, such as presenting information, asking questions, or monitoring learning. Navigation also clarifies starting and ending points. Navigation patterns can be described as the tools a learner uses to determine their current location, identify their next destination, and decide how to get there, in addition to the available options. Navigation provides freedom of movement within web pages, allowing learners to acquire more information and choose what suits their needs, thus helping them find the best learning path. (Somyürek, S.,2015).

What is website navigation?

Web navigation is the process of clicking on online resources, such as the different pages that make up a website. Users browse websites using a web browser. They click on links that take them to other pages. There are two types of links you can use to navigate websites:)McDowell, M., & Kosslyn, S. M. ,2020), (Rosenfeld, L., Morville, P., & Arango, J. ,2015)

- Internal links: These links connect to pages within the same website.
- External links: These links connect to other websites.

Navigation links are a means by which the learner can build communication channels between e-learning content, and enable him to understand how to navigate between screens in a way that suits his style and cognitive structure. These links also align with the way the content is organized and the tracking mechanisms the learner uses for selection and viewing. Therefore, adapting the navigation links facilitates the learner's movement within the educational content and enhances their interaction with it. (Micarelli, A., Sciarrone, F., & Gasparetti, F. ,2011), (Hsiao, I.-H., Brusilovsky, P., Yudelson, M., & Ortigosa, Á. ,2010)

Navigating a website is important for several reasons, including: (Saw, C. C. ,2022),(Jongmans, E., Jeannot, F., Liang, L., & Dampérat, M. ,2022)

The website Presents a clean and organized look: as the website represents the digital interface of the organization, its good organization and ease of use reflect the professionalism and reliability of the organization itself."(Cheng, T. H. ,2021).

Influences users' feelings: well-designed navigation system helps users find the information they need quickly and efficiently. A website can be viewed positively and accepted by users who encounter no obstacles in their search for information. (Guo, J., Zhang, W., & Xia, T. ,2023)

Increased site time: When a website is easy to navigate, it encourages users to stay longer, explore its content, and learn more about the material. Conversely, websites that are difficult to navigate usually push users to quickly switch between pages or view only one page before leaving the site. (Sharma, H., & Tripathi, K. ,2023).

Improves search engine optimization: Good navigation enables search engines to index the website more effectively, making it easier for users to find the site through search queries and improving its ranking in search results. (McDonald, J. ,2020) , (Barker, W. ,2021)

2.3. Tips To Help Users Navigate The Site Effectively

To get the most out of the site, it's important to familiarize yourself with some guidelines that will help you navigate easily and quickly find the content you're looking for. These tips provide simplified ways to move between pages and use the available tools effectively, making the user experience smoother and more flexible.) Gamboa, Y., Arenas, J. J., & Paz, F. ,2020).

1-Plan navigation with a sitemap: When deciding to create a website, it is best to adopt a forward-looking approach. Identify in advance the features and pages your site will need, and plan its organizational structure. Consider the following questions: Does the site need an "About Us" page, a blog, or a Frequently Asked Questions (FAQ) section? Which of these pages will be the most important and valuable to your visitors? (Le Cong, T., Le, X. B. D., Huynh, Q.-T., & Nguyen, P.-L. ,2022).

To develop this navigation effectively, it is recommended to create a comprehensive site map. The map should display all the main elements of the user interface along with their associated subcategories. Since the map forms the basis of the navigation menu, its creation makes it easy to clearly identify the most important and valuable pages for visitors. (Singla, B. S., & Aggarwal, H. ,2020).

2-Prioritize pages: When designing your website, it's crucial to identify which pages offer the most value to visitors. Consider user needs, the site's primary objectives, and the most requested content, then prioritize the pages according to their importance. This prioritization helps improve navigation, ensures visitors quickly access essential information, and enhances overall site effectiveness. There are some guidelines that should be followed: (Al Shobaki, M., Salim, J., & Al Ayyubi, I. ,2020) , (Silvis, I. M., et al , 2019).

- What information is most valuable to you and your website visitors?
- What is the primary purpose of visiting your website, and can visitors easily achieve this purpose through the navigation menu?
- Focusing on these questions helps you design a clear and effective user experience that ensures visitors quickly access important content and information. (Vargas Ochoa, I. ,2020).

3:Determine the number of elements included in the site: When designing a navigation menu or any page menu on your website, it's important to determine the number of items it will contain. The number of items should be sufficient to cover the

essential content without overwhelming the user or making the menu cluttered. A general rule is to maintain a balance between comprehensiveness and clarity. This allows users to process information easily and access their desired pages more quickly. Consequently, visitors can access important information easily and rapidly. (Gobert, C., Todi, K., Bailly, G., & Oulasvirta, A. ,2019)

4:Specify a clear name for the site: Once the elements that will appear on the site have been determined, careful consideration should be given to putting clear and expressive names for each page. Clarity is the top priority, so it is advisable to avoid using abbreviations or complex technical terms that may confuse visitors. (Kalbach, J., & Gustafson, A. ,2007).

Navigation labels should be clear, descriptive, concise, and specific rather than generic. In addition to helping visitors easily locate items, a well-labeled navigation menu also assists search engines like Google in understanding the site's content and topic, thereby enhancing its visibility in relevant search results. (Arriola, B. ,2019)

5:Linking the logo to the website's homepage: Overlooking the logo's link to the homepage is a common web design oversight—but it's easily avoided. There's no need to use the phrase "homepage" in menus (it can sound a bit outdated). Simply place the logo at the top of each page and link it to the homepage. This is intuitive for most users and will make navigating in site much smoother. (Loranger, H. ,2017)

6:Determine the user's current page: Feeling confused while navigating websites is undesirable for users, so it's important to guide them to their current location within the website. Breadcrumbs are one effective way to achieve this. They display the sequence of pages and show the user's position within the website's structure, helping them navigate easily and enhancing the user experience. (Shopify Staff. ,2023)

7:Users can access any page from any page: It's essential to ensure visitors can navigate to any page from any other page. Not every visitor starts from the homepage, so each page should link to the rest of the site to facilitate navigation and guarantee a good user experience. (Fanaras, L. ,2023).

The best way to ensure all pages are accessible from the menu is to ensure that each page contains a menu that allows users to navigate to all other pages. For a seamless user experience, it is advisable to maintain a consistent menu design across all pages and place it in the same location to avoid confusion. (Nazir, N. ,2023).

When dealing with long text pages, such as blog posts or educational content pages, hiding links is an effective navigation tool that helps users move quickly between different sections of the page.(Wang, H. H.,2023)

2.4. Adaptive Navigation Techniques

Adaptive navigation techniques are achieved by integrating or providing at least one of the following concepts within the learning environment: (Whittenburg, 2011).

1. Commenting on links: This method is based on attaching hyperlinks to additional comments or visual hints, which aim to clarify the content of the link and help the learner make an appropriate decision before clicking on it. (Somyurek & Yalin ,2014)
2. Link ordering: The ordering of links within pages is done according to the learner's model, with a focus on the pages that are most important to him. The most important links are placed at the beginning of the list to highlight their importance, and this method is usually applied to contextual links so that the order of the links is variable and not fixed. (Whittenburg ,J,2011)
3. Adaptive maps: A map is displayed to the learner showing the general structure of hyperlinks between elements of the educational content, along with the learner's position within this space. Techniques such as link hiding, annotation, and direct guidance are used to effectively support the presentation of the curriculum map. (Hamada, A. H. M. ,2023).
4. Link hiding: This technique involves hiding, removing, or disabling redundant links that lead to unnecessary or irrelevant pages. Link hiding is one of the most common methods for supporting adaptive navigation, as it aims to reduce navigation clutter and restrict browsing to only relevant pages, thus enhancing the learning experience.) Germanakos,P, Belk,M,2016) ، (Oboko, Wagacha,2012)
5. 5-Direct routing: Direct routing is one of the simplest methods of adaptive navigation, as it guides the learner towards the best next node to visit, or in some cases provides several alternative nodes, in accordance with his educational goals and cognitive style, with the aim of improving the effectiveness of navigation within the educational content.) Brusilovsky, 2015,P2).

The current research relied on the use of direct

routing and link hiding on the educational website. The researchers found that these were the most appropriate methods for navigating the context of the current research, which support the cognitive methods of the user and contribute to reducing digital stress, increasing acceptance of using the educational website, and improving the learning experience.

2.5. Link Hiding As A Navigation Tool On Educational Websites

Link hiding are an effective tool for simplifying navigation on long pages, such as those for courses or self-learning content. These links are typically placed outside the main menu, often at the top of the page, allowing users to skip unnecessary content and quickly access the sections most important to them. Hidden links provide a smoother navigation experience, reducing the time spent searching for information, increasing learning efficiency, and enhancing overall user satisfaction with the site.) Fang, X., & Holsapple, C. W. ,2011).

Link hiding are links that are not always visible in the main website menu but are designed to facilitate navigation within a single page or between related pages. These links are often placed at the top of the page or in a small sidebar, enabling users to quickly access important sections without having to scroll extensively or search through the content. By providing this direct navigation, hidden links enhance user efficiency, reduce cognitive effort, and improve overall satisfaction with the website. (Wang, H. H. ,2023).

2.6. The Importance Of Link Hiding In Educational Websites

Previous studies that addressed the link-hidden navigation style have shown that it is of great importance in the design of educational website environments, and this importance can be summarized as follows:

- Facilitating Navigation Between Educational Content : Link hiding enable students to quickly reach the most important sections within a single page or across related content pages, without the need for excessive scrolling or manual searching. This feature is particularly valuable in long lessons or complex online courses, as it allows learners to efficiently locate key information, maintain focus, and optimize their learning experience. By reducing unnecessary navigation effort, hidden links contribute to a smoother and more effective educational process.) Li, S.-W. ,2020).
- Improving ease of use and enhancing effective learning experiences : Link hiding are considered a highly important tool in educational websites, as they enable students to quickly access key sections within a page or between related content pages without the need for extensive scrolling or prolonged searching (Wang, 2023). This allows learners to focus more on understanding the content rather than spending time navigating the user interface. Consequently, hidden links not only improve learning efficiency but also enhance users' acceptance of and satisfaction with the educational platform. Moreover, they support different cognitive styles: field-independent learners can explore content autonomously, while field-dependent learners benefit from clear and well-structured pathways that guide them through the learning material. Therefore, integrating Link hiding into educational websites is essential for improving usability and promoting effective learning experiences. (Wang, H. H. ,2023)
- -Increased learning effectiveness : Providing students with quick and direct access to important content enhances their ability to focus and comprehend the material. This streamlined access reduces distractions and cognitive load, allowing learners to allocate more mental resources to understanding and retaining information. As a result, self-directed learning becomes more efficient, and learners are more likely to retain knowledge effectively, which is especially beneficial in complex or lengthy online courses. (Shanthi, A., et al., 2025).
- Improving User Experience and Website Acceptance : Hidden links contribute to a smoother and more user-friendly experience on educational websites. By enabling quick and direct access to relevant content, they reduce navigation effort and cognitive load, which increases learner satisfaction. This improved usability encourages continued engagement and fosters higher acceptance of the educational platform, supporting both self-directed learning and overall educational outcomes.)Karani, A., Thanki, H., & Achuthan, S.,2021).
- Supporting Different Learning Styles :Hidden links support diverse learning styles by accommodating both independent and

dependent learners. Field-independent students can use these links to navigate and explore content according to their own learning plans, allowing them to study autonomously and at their preferred pace. In contrast, field-dependent students rely on clear and well-structured links to guide them through the material, helping them follow a more organized learning path and reducing cognitive overload. By providing flexible navigation options, hidden links enhance usability for all learners and promote more effective learning experiences. (Ford, N., Miller, D., & Moss, N,2001).

Link hiding plays a significant role in supporting different learning styles within educational websites. Field-independent learners can utilize these links to explore content autonomously according to their own plans, navigating freely and focusing on the sections they consider most relevant. In contrast, field-dependent learners benefit from clear and structured hidden links that guide them step by step through the material, reducing cognitive overload and helping them follow a more organized learning path. By accommodating these diverse cognitive styles, hidden links enhance usability, promote effective learning, and improve user satisfaction across a wide range of learners. This aligns with research indicating that learners' cognitive styles influence how they interact with online learning environments, with field-independent students favoring autonomous, non-linear navigation, and field-dependent students benefiting from guided navigation (Ford, Miller, & Moss, 2001).

- Freedom to choose the path within the educational website: Hidden links give users greater freedom to choose their own path within the educational site, without feeling directed or forced to follow a specific educational sequence. These links also help reduce clutter and visual noise on long or content-rich pages, compared to direct routing methods that may occupy a large area of the screen with multiple visual elements and signals. As a result, hidden links are more suitable for advanced or digitally experienced users, as they promote site acceptance by supporting independence, reducing visual strain, and enabling self-control over the learning path, in line with their cognitive preferences and educational goals.)Wenzel, A., & Moreno, J. ,2022).

3. THEORIES SUPPORTING THE METHOD OF NAVIGATION : LINK HIDING

Self-Directed Learning Theory: Emphasizes the importance of learner autonomy in choosing their learning path. Hidden links support this approach because they give users the freedom to explore the site and choose what they want to learn without strict guidelines (Knowles, M. S. (1975),)Murillo Noriega, D. E. ,2025).

Discovery Learning Theory: states that learning is deeper when the learner discovers knowledge for themselves. Hidden connections encourage students to explore the content on their own, promoting critical thinking and problem-solving (Bruner, J. S. ,1961),) Manurung, A. S., & Pappachan, P. ,2025).

Cognitive Flexibility Theory:Proposes that learning is most effective when learners can change their learning paths and strategies as needed. Hidden links allow users to customize their learning experience and navigate between units in multiple ways.(Spiro, R. J., et al., 1991) , (Wang, Y., Wu, T., Liu, H., & Brown, C. ,2025)

Multiple Pathways Learning Theory: Each learner can follow a different learning path according to their interest. Hidden links support this diversity, as the user can choose to move to specific content without being bound by a specific sequence.)Amzil, I., Aammou, S., & Tagdimi, Z.,2023)

3.1. Direct Routing As A Tool For Navigating Educational Websites

Direct routing an effective tool for facilitating navigation within educational websites, as it provides learners with a clear path to quickly and easily access the required educational content by using visual cues, clear buttons, specific text links, and prominent headings, students can jump directly to relevant lessons, activities, or resources without the need for long scrolling or manual searching.(Hwang, G.-J., & Tu, N.-T. ,2023) This approach helps reduce the time and effort spent navigating the site, alleviates the digital stress associated with online learning, and promotes students' acceptance of using the site and their continuity in self-learning. Direct guidance is an important design tool to support the diverse cognitive styles of learners, whether they are field-independent or field-dependent, by providing clear and easy-to-follow learning pathways.(Shanthi, A.,et al., 2025)

Direct routing is a design approach used to clearly guide users within a website, ensuring that they always have a clear understanding of what actions to

take or where to find the required information. This approach includes the use of prominent visual cues, clear buttons, distinctive headings, or specific text links that help users navigate directly to the intended content or section. Direct guidance is particularly used in educational websites to support students in quickly accessing lessons, resources, or learning activities, which reduces the cognitive effort required during navigation and enhances the overall e-learning experience.) Beege, M., Scherer, D., & Weiß, E. ,2023).

3.2. The Importance Of The Direct Routing Approach On Educational Websites

Previous studies that addressed the direct navigation approach have shown that it is of great importance in the design of educational website environments, and this importance can be summarized as follows:

1. Reducing distractions: Direct guidance on educational websites helps reduce distractions for students, as it allows them to focus on the next steps in the learning process without wasting time searching for required content or tasks.)Davids, R., Halperin, M. L., & Chikte, U. M. E. ,2015). Accelerated access to information, allowing users to go directly to relevant lessons, quizzes, or educational resources, thus enhancing learning efficiency and reducing digital fatigue associated with prolonged site navigation. Additionally, it supports Direct routing. (Idkhan, A. M., & Idris, M. M. ,2023).
2. The diversity of learners' cognitive styles is significant: Cognitively independent learners can freely explore content according to their study plans, while domain-dependent learners require clear and structured pathways to facilitate their engagement with the learning material. Therefore, direct routing is a crucial design tool for improving student satisfaction, site acceptance, and continued self-directed learning. (Kim, C., & Macredie, R. D. ,2002)
3. Improving the user experience: direct routing helps improve the user experience on educational websites, as it makes the browsing process easier and clearer, and allows students to access educational content quickly and effectively. This leads to increased student satisfaction with the site and a reduced likelihood of them leaving the platform, which enhances their continuity in self-learning and makes the educational experience smoother and more efficient. (Alqurni, J. ,2023).
4. Supporting New Students: direct routing dance helps support new students, especially those who are unfamiliar with the website structure or how to access educational content. It provides them with a clear roadmap to explore resources, lessons, and learning activities, making it easier for them to adapt to the platform quickly and reducing distractions and frustration during initial navigation. This support contributes to enhancing students' confidence in the site and increases the likelihood of their continued engagement in self-directed learning. (Ahmed, J., Laghari, S., & Siddique, M. E. (2023)

Unlike hidden links or main menus, direct routing provides immediate and clear instructions for the next step, helping students follow the educational content efficiently without the need to search extensively for required information. This approach also enhances the user experience in complex tasks or long pages and works complementarily with other navigation elements such as menus, hidden links, and breadcrumb trails, ensuring learners can access target content quickly and effectively while reducing digital fatigue. (Ahmed, J., Laghari, S., & Siddique, M. E. (2023).

Direct routing significantly reduces digital stress, as it provides learners with clear and straightforward steps while interacting with the educational website, thus minimizing the need for overthinking or constant searching for required information. This clarity helps reduce the cognitive burden associated with navigation and decision-making processes, and enables learners to focus on the educational content itself rather than being preoccupied with how to use the site, which improves the learning experience and increases its efficiency. (Alqurni, J. S. ,2023).

3.3. Theories Supporting The Direct Routing Navigation Method

Guided Learning Theory: This theory suggests that learners learn more effectively when they have clear guidance and specific steps throughout the learning process. This reduces ambiguity and ensures that users achieve the desired learning objectives. (Liu, Z.,et al., **2024)**

Cognitive Load Theory: Proposes that learning is most effective when the cognitive load is minimal. Direct instruction reduces the need for searching and overthinking the steps involved, thus decreasing mental strain and enhancing focus on the learning content.(Surbakti, R.,et al ., 2024)

Behavioral Learning Theory: Focuses on promoting correct behaviors through positive reinforcement and feedback. Direct instruction can

include visual cues or messages that emphasize the completion of a particular step, which promotes progress behavior and interaction with the content.)Buhamad, A. M. ,2024).

Task-Based Learning Theory: Suggests that learners learn better when they have clear and specific tasks. Direct routing provides clear instructions about the next task, such as moving on to the next unit or taking a test, thus focusing the learner on the desired goal.)Rashid, S. N. ,2025).

The third theme: The relationship between navigation styles, cognitive style, digital stress, and acceptance of use

This section examines the impact of navigation methods on educational websites (direct routing and link hiding) and the cognitive style of learners, and the extent to which they contribute to reducing digital stress resulting from an abundance of information or complexity in browsing, and thus increasing the acceptance of using educational websites.

Learners' cognitive styles affect how they interact with educational websites. Field-independent learners benefit from direct guidance and can freely navigate content (Palmquist & Kim, 2000), while field-dependent learners need clear links and guidance to reduce cognitive load and digital stress, which also influences their site acceptance (Zhang, 2023).

Cognitive styles are defined as the characteristic patterns individuals use to process and understand information, reflecting individual differences in thinking and learning, and influencing their interaction with digital learning environments.)Witkin, H. A.,et al., 1977)

3.3.1. Cognitive styles (Field-Independent / Field-Dependent)

- Field-Independent:

Able to analyze information independently and extract key elements even in complex environments.

- Field-Dependent:

Requires external organization and clear guidance to understand content, and is influenced by the overall context of information. (Zhang, J. ,2025)

Digital stress is significantly influenced by website design and navigation style. Direct routing reduces stress for beginners, while hidden links provide advanced users with the freedom to explore content. A balanced design that combines both approaches and incorporates navigational aids can substantially reduce digital stress and enhance the learning experience. Digital stress occurs when users must exert excessive effort to process digital information, which decreases learning effectiveness and negatively impacts the user experience.)Saleem, F., Chikhaoui, E., & Malik, M. I. ,2024).

It indicates that the factors leading to digital stress in educational websites include: excessive information and links or long menus; difficulty in navigation or unclear guidance; lengthy educational pages without supportive tools such as progress bars or pinned links; and repeated notifications or visual elements that distract the user's attention.)Upadhyaya, P., & Vrinda, K.,2024).

According to a study) Masrek, M. N., Baharuddin, M. F., & Jalil, A. ,2025).Hidden links increase cognitive and psychological digital stress due to searching, distraction, and frustration. On the contrary direct routing reduces digital stress and makes learning smoother and more efficient. In summary, designing educational websites with clear and direct guidance contributes to reducing psychological pressure and fatigue associated with digital learning.) Faudzi, M. A et al., 2024)

This is further supported by the study)DeStefano, D., & LeFevre, J. A,2008). which indicates that hidden links increase cognitive load, cause psychological frustration, distract attention, and prolong learning time.

Conversely, direct routing within educational websites plays a critical role in mitigating cognitive load by providing learners with clear, structured instructions and visual cues that facilitate efficient access to information without the need for extensive searching or navigating complex interfaces. This approach further enhances learning efficiency by allowing students to concentrate on essential content rather than becoming preoccupied with navigation or site structure. Additionally, direct guidance significantly improves the overall user experience, fostering a sense of control and confidence during system interaction, thereby reducing frustration and cognitive distraction.)El Shamy, Y. H. ,2022) , (Alqurni, J. S. ,2022).

Acceptance of educational websites refers to the extent to which learners are willing to use and continue interacting with these platforms, based on their perception of the educational value, ease of use, and the impact on the quality of their learning experience.)Saqr, R. R., Al Somali, S. A., & Sarhan, M. Y. ,2024).

The impact of direct routing and link hiding on the acceptance of educational websites is evident in that navigation methods within a site directly influence learners' willingness to use the platform and continue interacting with it. direct routing, which provides clear steps and explicit links,

enhances ease of access to content and cognitive clarity for users, increasing learner satisfaction and encouraging continued use of the site. In contrast, hidden links or complex navigation may lead to increased cognitive load, distraction, and frustration, reducing user acceptance and negatively affecting their learning experience.)Dimitrijević, S., & Devedžić, V. ,2020).

Conversely, link hiding or complex navigation structures can negatively impact the acceptance of educational websites. Such design elements often increase cognitive load, cause frustration, and distract learners, making it more difficult for them to access content efficiently. As a result, user satisfaction decreases, and learners are less likely to continue interacting with the platform, ultimately reducing their overall acceptance and engagement with the digital learning environment.(Shanthi, A.., et al., 2025)

Link hiding outperform direct guidance in user acceptance among more experienced users, as they provide greater freedom, reduce visual clutter, and support a more personalized learning experience. While direct guidance is more suitable for beginners or critical steps, a strategic combination of both approaches can offer a balanced and effective experience for users across different expertise levels.)Ferreira, J. M.et al ., 2024).

By reviewing previous studies it becomes clear that there is a discrepancy in the results related to the design discrepancy in the results related to studies on navigation methods in educational website environments and their impact on digital stress and user acceptance. Therefore, the current research aims to develop and produce two navigation methods within educational websites: (direct routing /link hiding) and the learner's cognitive style (independent/dependent) on the cognitive field. And to reveal the effect of their interaction in reducing digital stress and increasing students' Usability the e-learning environment

3.4. Search Problem

Despite the widespread use of e-learning environments within educational institutions, such as learning management systems like Moodle, they rely on standardized navigation methods that do not take into account the individual differences between students , This leads to the interface becoming cluttered with links and content, increasing the cognitive load, and consequently raising the level of digital stress among students, negatively affecting their acceptance of using these environments and their continuity in learning through them.

Similarly, variables such as digital stress and acceptance of use are relatively recent in educational technology research and have not received sufficient study within an integrated framework that links them to adaptive navigation methods and cognitive style within a single e-learning environment.

The research problem is defined as the need to identify the effectiveness of adaptive navigation methods (link hiding - direct routing) in light of the cognitive style on the perceptual field (independence - dependence) within an electronic learning environment, and the effect of this on reducing digital stress and acceptance of use among students.

3.5. Research objectives

The research aims to study the effectiveness of adaptive navigation techniques (link hiding - direct routing) in light of the cognitive style on the perceptual field (independence - dependence) within an electronic learning environment, and the effect of this on reducing digital stress and acceptance of use among students.

- To determine the impact of adaptive navigation techniques (hiding links – direct routing) in an e-learning environment on reducing students' digital stress levels.
- To determine the impact of adaptive navigation techniques (hiding links – direct routing) in an e-learning environment on students' Usability these techniques.
- To identify differences in digital stress levels based on cognitive style (independent /dependent).
- To identify differences in Usability based on cognitive style (independent/dependent).
- A study of the interaction between adaptive navigation techniques and cognitive style on the cognitive domain in reducing digital stress among students.
- A study of the interaction between adaptive navigation techniques and cognitive style on the cognitive domain in Usability of the e-learning environment.
- Identifying the most effective adaptive navigation method (hide links or direct routing) for each cognitive style in reducing digital stress and increasing Usability.
- Providing a procedural model for employing adaptive navigation methods within the Moodle environment in accordance with the learners' cognitive style.

3.6. The Importance Of Research

The importance of this research stems from its examination of the effectiveness of adaptive navigation techniques, from a cognitive perspective, within the cognitive domain of an e-learning environment. It explores the impact of this on reducing digital fatigue and fostering user acceptance, thereby contributing to improved design of e-learning environments and addressing individual learner differences. This, in turn, contributes to:

- Guiding e-learning environment designers on how to employ adaptive navigation techniques that align with learners' cognitive styles.
- Contributing to reducing digital stress among students by providing adaptive learning pathways that minimize cognitive load and distractions during e-learning.
- To improve student acceptance of e-learning environments, thereby supporting continued use and positive interaction with learning management systems such as Moodle.
- To provide a practical procedural model applicable within e-learning environments that can be utilized in various university courses.
- Assisting faculty members in selecting the most suitable navigation method for students based on their learning styles, thereby contributing to improved learning outcomes.
- Supporting educational decision-makers in adopting cognitively adaptive instructional designs within e-learning systems.

3.7. Research Limits

- Students of the first semester of the Department of Educational Technology and Computer Science at the Faculty of Quality Education, Kafr El-Sheikh University
- Two types of adaptive navigation methods (hide links – direct routing) in the e-learning environment.
- Cognitive style on the perceptual field (independence - dependence) in the e-learning environment
- Measuring the level of digital stress reduction and the level of student Usability in the e-learning environment.

4. RESEARCH DESIGN AND PARTICIPANTS

4.1. Research Methodology

The current research follows a descriptive approach to define the specifications and standards of the proposed e-learning environment, and a quasi-experimental approach to measure the effect of the interaction between adaptive navigation styles (link hiding, direct routing) and cognitive style (independence-dependence) on the perceptual field in the e-learning environment on reducing digital stress and acceptance of use among students.

4.1.1. Experimental Design

The current research follows an experimental design to determine the effect of independent research variables (adaptive navigation styles and cognitive style) on reducing digital stress and increasing user acceptance among educational technology students. In light of the independent variables of the research, the experimental design (2 x 2) was used, and the following table shows the experimental design of the research.

Experimental Design of the Research

Cognitive style	**adaptive navigation methods**	
	link hiding	direct routing
independence	Experimental Group (1) link hiding + independence	Experimental Group (2) direct routing + independence
dependence	Experimental Group (3) link hiding + dependence	Experimental Group (4) direct routing + dependence

4.1.2. Participants In The Research Experiment

The research sample consisted of 60 first-year students (males and females) from the Department of Educational Technology, Faculty of Specific Education, Kafr El-Sheikh University. The participants were divided into four homogeneous groups, with 15 students in each group, as follows:

- The first group: They have access to adaptive navigation techniques (hiding links) and cognitive style (independence) on the cognitive field in the e-learning environment.
- The second group: They have access to adaptive navigation methods (direct routing) and cognitive style (independence) on the cognitive field in the e-learning environment.
- The third group: They have access to adaptive navigation techniques (link hiding) and cognitive style (dependence) on the cognitive field in the e-learning environment.
- The fourth group: They have access to adaptive navigation methods (direct routing) and cognitive style (dependence) on the cognitive field in the e-learning environment.

4.1.3. Search Tools

- Digital stress reduction scale for the learning environment
- Usability scale for the learning environment
- Group Embedded Figures Test (GEFT)
- An adaptive learning environment, which is an electronic platform that changes according to the research variables, and the Moodle learning management system was used.

4.1.4. Research Hypotheses

1. There are statistically significant differences at the significance level ($\alpha \geq 0.05$) between the mean scores of the experimental groups that use adaptive navigation methods (link hiding - direct routing) in the e-learning environment on reducing digital stress.
2. There are statistically significant differences at the significance level ($\alpha \geq 0.05$) between the mean scores of the experimental groups that use the cognitive approach on the perceptual domain (independence - dependence) in the e-learning environment on reducing digital stress.
3. There are statistically significant differences at the significance level of ($\alpha \geq 0.05$) between the mean scores of the four experimental groups due to the effect of the interaction between adaptive navigation methods (link hiding - direct routing) and the cognitive style on the perceptual field (independence - dependence) in the e-learning environment on reducing digital stress.
4. There are statistically significant differences at the significance level ($\alpha \geq 0.05$) between the mean scores of the experimental groups that use adaptive navigation methods (link hiding - direct routing) in the e-learning environment on Usability.
5. There are statistically significant differences at the significance level of ($\alpha \geq 0.05$) between the mean scores of the experimental groups that use the cognitive approach on the cognitive domain (independence - dependence) in the e-learning environment on the Usability.
6. There are statistically significant differences at the significance level of ($\alpha \geq 0.05$) between the mean scores of the four experimental groups due to the effect of the interaction between adaptive navigation methods (link hiding - direct guidance) and the cognitive style on the perceptual field (independence - dependence) in the e-learning environment on Usability.

4.2. Search Procedures

First: The preparation and equipment stage

4.2.1. Defining the Educational Content

Based on the general objectives of the Learning Resource Centers course for the first year, Department of Educational Technology and Computer Science, Faculty of Specific Education, Kafr El-Sheikh University, the scientific content was determined and prepared, According to the research variables, adaptive navigation methods (link hiding - direct routing) were used to determine the impact of digital stress and the acceptance of use of the e-learning environment.

4.2.2. Designing The Scientific Content

The scientific content was identified and divided into parts in order to create follow-up links and display the content, as well as identifying the external links that will be used, and defining the restrictions for opening and displaying the different links on the electronic environment.

4.3. Introduction (Introductory Lecture)

This step aims to prepare students to familiarize themselves with the educational platform in order to prevent difficulties during operation and to define what is required of them during the learning process, in order to prevent any effects that may result from the learning management system used and affect the search results. The lecture covered the following:

- Explaining to students the guidelines for using the online learning platform and its requirements.
- Guiding students on how to use the Moodle learning management system and access its various links.
- Scheduling online exams for the course through the website control panel.
- Explaining the correct navigation and link opening procedures for each group on the Moodle e-learning platform.

4.4. Defining And Selecting Experimental Groups

The Group Embedded Figures Test (GEFT) Scale was applied to a large number of first-year students in the Department of Educational Technology and Computer Science at the Faculty of Specific Education, Kafr El-Sheikh University, with the aim of determining the cognitive style of each student's cognitive domain (independence or dependence) , 40 students were selected based on their cognitive characteristics (independence) and 40 students based

on their cognitive characteristics (dependence). The students were then divided into four main groups of 20 students each in order to implement the research variables.

Second: Design and Production Phase

4.4.1. Building An Electronic Learning Environment

The e-learning environment was built using the Moodle learning content management system, which allows for the publication of course content and includes design tools suitable for search variables, Adaptive navigation methods (link hiding) allow students to see only content appropriate to their level or progress, reducing cognitive load and digital fatigue. Adaptive navigation methods (direct routing) automatically guide students to the next most suitable activity instead of leaving them to choose.

4.4.2. Student Registration On The Moodle Learning Management System

The data of the 80 students in the research sample was recorded on the Learning Management System (LMS) on the e-learning environment, with each student given a username and password, and they were divided into four groups on Moodle.

4.4.3. Dividing students into groups based on research variables

After registering, students were classified into four groups on the learning management system based on the research variables, as follows:

- Group No. (1): 20 students using adaptive navigation techniques (hiding links) and the cognitive style (independence) on the perceptual field in the e-learning environment
- Group No. (2): 20 students using adaptive navigation methods (direct routing) and the cognitive style (independence) on the perceptual field in the e-learning environment
- Group No. (3): 20 students using adaptive navigation methods (hiding links) and the cognitive method (dependence) on the cognitive field in the e-learning environment.
- Group No. (4): 20 students using adaptive navigation methods (direct routing) and the cognitive method (dependence) on the cognitive field in the e-learning environment.

4.4.4. Building Adaptive Navigation Methods On The Moodle Learning Management System.

Navigation methods were designed and built according to the search variables on Moodle as follows:

- Adaptive navigation techniques (hiding links)

Content appropriate to the student's progress level is displayed, while other parts are hidden. This was implemented within Moodle using the following steps:

- Enable course completion tracking.
- Set a completion requirement for the previous activity; open the activity (video, lesson, quiz).
- Hide the following link by enabling the "Hide activity" option.
- Adaptive navigation methods (direct routing)

The student was directed directly to the next most appropriate activity and was not allowed to choose; this was implemented within Moodle as follows:

- Use Lesson activity, which supports different paths, automatic transitions, and adaptive branching
- Implementation using Page + Button; the link leads to the next activity.

4.5. Building Measuring Tools

4.5.1. Digital Stress Reduction Scale

This assessment aims to measure the learner's ability to reduce or manage digital stress resulting from technology use, such as excessive notifications, digital multitasking, time pressure, distraction, and fatigue due to screens. It is applied to e-learning and distance learning.

Based on studies and research that addressed reducing digital stress, the Digital Stress Reduction Scale statements were formulated. The scale consists of 20 statements distributed across four dimensions, answered according to a five-point Likert scale as follows: (1 = Not at all applicable to me) (2 = Applies slightly) (3 = Applies moderately) (4 = Applies greatly) (5 = Applies very much).

Dimensions of the Digital Stress Reduction Scale: It consists of 20 statements distributed across 4 dimensions as follows:

- Digital Time Management
- Controlling Notifications and Distractions
- Managing Digital Tasks
- Digital Well-being

Correction and scoring are done for the digital stress reduction scale, where scores range from 20 to 100, and the level of digital stress reduction is interpreted as follows: very low (20-39), low (40-59), medium (60-79), high (80-100).

4.5.2. Usability Scale

The UTAUT2 model for Usability of the e-learning environment was used, which is suitable for the research variables and shows the actual intention to use and the real behavior towards technology, especially in educational environments. The scale consists of 21 statements distributed over seven dimensions, A five-point Likert scale was used to estimate the level of the scale, (1 = Strongly Disagree) (2 = Disagree) (3 = Neutral) (4 = Agree) (5 = Strongly Agree)

4.5.3. Scale Dimensions: 21 Statements Distributed Across Seven Dimensions :

1. Performance Expectancy
2. Effort Expectancy
3. Social Influence
4. Facilitating Conditions
5. Hedonic Motivation
6. Habit
7. Behavioral Intention

Correction and scoring are done for the usability scale, where scores range from 21 to 105, and the scale level is interpreted as follows: Low (21-49), Medium (50-77), High (78-105).

Third: The research experiment implementation phase

4.5.4. Applying Dimensional Measurement Tools

A digital stress reduction scale was applied post-tested to measure student feelings after interacting with the e-learning environment, and the extent to which digital stress was reduced as a result of using the research variables. The use acceptance scale was applied post-tested to measure the use and sense of ease of the learning environment, and through the scores obtained and then calculating the average score for each group, the research hypotheses were verified.

4.6. Research Results and Discussion

4.6.1. Presenting The Results Related To Reducing Digital Stress

Two-way analysis of variance was used between students' scores on the post-test digital stress scale to verify the research hypotheses, and the results were as follows:

Tabl
Two-way analysis of variance between students' scores on the digital post-test stress scale

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8777.800[a]	3	2925.933	65.650	.000
Intercept	142805.000	1	142805.000	3204.175	.000
navigation	7527.200	1	7527.200	168.891	.000
Cognitive style	897.800	1	897.800	20.144	.000
navigation * Cognitive style	352.800	1	352.800	7.916	.006
Error	3387.200	76	44.568		
Total	154970.000	80			
Corrected Total	12165.000	79			

The results in Table 1 show statistically significant differences between adaptive navigation styles (hide links – direct routing) and cognitive style on the perceptual domain (independence – dependence) in the digital stress scale.

Hypothesis No. 1: "There are statistically significant differences at the significance level ($\alpha \geq 0.05$) between the mean scores of the experimental groups that use adaptive navigation methods (link hiding - direct routing) in the e-learning environment on reducing digital stress.."

From the results in Table 1, we find that the significance level is significant at a level less than 0.05 in adaptive navigation methods (link hiding - direct routing), which indicates that there are significant differences between the mean scores of the digital stress reduction scale for the experimental groups. To determine the direction of the hypothesis, the averages of the groups using adaptive navigation methods (link hiding - direct routing) were calculated, regardless of the other variable, as shown in Table 2.

Table 2

Averages of groups using adaptive navigation methods

navigation	Mean	N	Std. Deviation
link hiding	51.9500	40	9.55403
direct routing	32.5500	40	5.25723
Total	42.2500	80	12.40916

The results of the previous table show that adaptive navigation methods (direct routing) have the lowest average score of (32.55), indicating a very

low level of digital stress, while adaptive navigation methods (link hiding) have the highest average score of (51.95), indicating a low level of digital stress.

Based on the previous result, hypothesis No (1) was accepted and the direction of the difference was determined which is: "There are statistically significant differences at the significance level of (α ≥ 0.05) between the mean scores of the experimental groups that use adaptive navigation methods (link hiding - direct routing) in the e-learning environment on reducing digital stress in favor of the experimental groups that use adaptive navigation methods (direct routing)."

Hypothesis No. 2: "There are statistically significant differences at the significance level (α ≥ 0.05) between the mean scores of the experimental groups that use the cognitive approach on the perceptual domain (independence - dependence) in the e-learning environment on reducing digital stress."

From the results of Table 1, we find that the significance level is significant at a level less than 0.05 in the cognitive style on the cognitive domain (independence - dependence), which indicates the existence of significant differences between the mean scores of the digital stress reduction scale for the experimental groups. To determine the direction of the hypothesis, the averages of the groups using the cognitive style on the cognitive domain (independence - dependence) were calculated, regardless of the other variable, as shown in Table 3.

Table 3: Average scores on the digital stress reduction scale in cognitive style

Cognitive style	*Mean*	*N*	*Std. Deviation*
independence	*38.9000*	*40*	*10.32498*
dependence	*45.6000*	*40*	*13.50176*
Total	*42.2500*	*80*	*12.40916*

The results of the previous table show that the cognitive style on the perceptual domain (independence) has the lowest average score of (38.9), which indicates a very low level of digital stress. The cognitive style on the perceptual domain (dependence) has the highest average score of (45.6), which indicates a low level of digital stress.

Based on the previous result, hypothesis No. (2) was accepted and the direction of the difference was determined, i.e.: "There are statistically significant differences at the significance level of (α ≥ 0.05) between the mean scores of the experimental groups that use the cognitive approach on the perceptual domain (independence - dependence) in the e-learning environment on reducing digital stress, In favor of experimental groups that use the cognitive approach on the perceptual field (independence)".

Hypothesis No. (3): "There are statistically significant differences at the significance level of (α ≥ 0.05) between the mean scores of the four experimental groups due to the effect of the interaction between adaptive navigation methods (link hiding - direct routing) and the cognitive style on the perceptual field (independence - dependence) in the e-learning environment on reducing digital stress."

From the results of Table 1, it is clear that the significance level is significant at the 0.01 level in the interaction between the first variable (adaptive navigation methods) and the second variable (cognitive style), which indicates the existence of significant differences between the mean scores of the post-test digital stress reduction scale for the four experimental groups that use the interaction between the two variables , To determine the direction of the reaction, the average scores of the digital stress scale were calculated for each experimental group, and then the level of digital stress reduction for each group was calculated as shown in Table 4.

Table 4: Level Of Digital Stress Reduction For Each Experimental Group.

cognitive style	adaptive navigation methods	group	N	Mean	Level of Digital stress reduction
dependence	link hiding	1	20	46.50	medium
	direct routing	2	20	31.30	Very low
dependence	link hiding	3	20	57.40	medium
	direct routing	4	20	33.80	Very low

From the results of the previous table, it is clear that the second experimental group, which uses adaptive navigation methods (direct guidance) with the cognitive method on the perceptual field (independence), has the lowest average score of (31.3), which indicates a very low level of digital stress , This confirms that using adaptive navigation techniques (direct guidance) with a cognitive approach to the perceptual field (independence) leads to a significant reduction in digital stress among students.

Based on the previous result, hypothesis number

(3) was accepted, and the direction of the reaction was determined, i.e., that: " There are statistically significant differences at the significance level (α ≥ 0.05) between the mean scores of the four experimental groups, attributable to the interaction effect between adaptive navigation styles (link hiding – direct routing) and cognitive style on the perceptual domain (independence – dependence) in the e-learning environment on reducing digital stress. In favor of the interaction between the type of adaptive navigation style (direct guidance) with the cognitive style on the perceptual field (independence)".

4.7. Presentation Of Results On Usability

Two-way analysis of variance was used between students' scores on Usability scale to verify the research hypotheses, and the results were as follows:

Table 5: Two-Way Analysis Of Variance Between Students' Scores On The Post-test Usability scale

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3934.950[a]	3	1311.650	18.638	.000
Intercept	452102.450	1	452102.450	6424.071	.000
navigation	3354.050	1	3354.050	47.659	.000
Cognitive style	572.450	1	572.450	8.134	.006
navigation * Cognitive style	8.450	1	8.450	.120	.730
Error	5348.600	76	70.376		
Total	461386.000	80			
Corrected Total	9283.550	79			

The results in Table 5 show statistically significant differences between adaptive navigation styles (hide links – direct routing) and cognitive style on the perceptual domain (independence – dependence) in Usability scale.

Hypotheses No. 4: There are statistically significant differences at the significance level (α ≥ 0.05) between the mean scores of the experimental groups that use adaptive navigation methods (link hiding - direct routing) in the e-learning environment on Usability

From the results in Table 5, we find that the significance level is significant at a level less than 0.05 in adaptive navigation methods (link hiding - direct routing), which indicates that there are significant differences between the mean scores of the usability scale for the experimental groups. To determine the direction of the hypothesis, the averages of the groups using adaptive navigation methods (link hiding - direct routing) were calculated, regardless of the other variable, as shown in Table 6.

Table 6

Average scores on Usability scale in adaptive navigation methods

adaptive navigation methods	Mean	N	Std. Deviation
link hiding	81.6500	40	9.09649
direct routing	68.7000	40	8.32420
Total	75.1750	80	10.84035

The results of the previous table show that adaptive navigation methods (hiding links) have the highest average score of (81.65), indicating a high level of usability, while adaptive navigation methods (direct routing) have the lowest average score of (68.70), indicating a moderate level of usability.

Based on the previous result, hypothesis number (4) was accepted, and the direction of the difference was determined, i.e., that: " There are statistically significant differences at the significance level of (α ≥ 0.05) between the mean scores of the experimental groups that use adaptive navigation methods (link hiding - direct routing) in the e-learning environment on usability, For the benefit of experimental groups using adaptive navigation techniques (link hiding) "

Hypothesis No. (5): "There are statistically significant differences at the significance level of (α ≥ 0.05) between the mean scores of the experimental groups that use the cognitive approach on the cognitive domain (independence - dependence) in the e-learning environment on the Usability."

From the results in Table 5, we find that the significance level is significant at a level less than 0.05 in the cognitive style on the cognitive domain (independence - dependence), which indicates the existence of significant differences between the mean scores of the acceptance of use scale for the experimental groups , To determine the direction of the hypothesis, the averages of the groups using the cognitive approach on the cognitive domain (independence - dependence) were calculated, regardless of the other variable, as shown in Table 7.

Table 7

Average scores of the post-test Usability scale in cognitive style

Cognitive style	Mean	N	Std. Deviation
independence	77.8500	40	11.47249
dependence	72.5000	40	9.57829
Total	75.1750	80	10.84035

The results of the previous table show that the cognitive style on the perceptual domain (independence) has the highest average score of (77.85), which indicates a high level of Usability. The cognitive style on the perceptual domain (dependence) has the lowest average score of (72.5), which indicates a moderate level of Usability.

Based on the previous result, hypothesis number (5) was accepted, and the direction of the difference was determined, i.e., that: "There are statistically significant differences at the significance level of ($\alpha \geq 0.05$) between the mean scores of the experimental groups using the cognitive approach on the perceptual domain (independence - dependence) in the e-learning environment on Usability , In favor of experimental groups that use the cognitive approach on the perceptual field (independence) ".

Hypothesis No. 6: "There are statistically significant differences at the significance level of ($\alpha \geq 0.05$) between the mean scores of the four experimental groups due to the effect of the interaction between adaptive navigation methods (link hiding - direct guidance) and the cognitive style on the perceptual field (independence - dependence) in the e-learning environment on Usability.

The results in Table 5 show that the significance level is not statistically significant in the interaction between the first variable (adaptive navigation methods) and the second variable (cognitive style), as the significance level reached (0.730), indicating that there are no statistically significant differences between the mean scores of the post-test Usability scale for the four experimental groups using the interaction between the two variables, To determine the best groups, the average scores of the usability scale were calculated for each experimental group, and then the usability level for each group was determined, as shown in Table 8.

Table 8: Usability level for each experimental group

cognitive style	adaptive navigation methods	group	N	Mean	Level of Digital stress reduction
dependence	link hiding	1	20	84.65	high
	direct routing	2	20	71.05	medium
dependence	link hiding	3	20	78.65	high
	direct routing	4	20	66.35	medium

From the results of the previous table, it is clear that the first experimental group that uses adaptive navigation methods (hiding links) with the cognitive method on the perceptual field (independence) has the highest average score of (84.65), which indicates a high level of usability, This confirms that using adaptive navigation techniques (hiding links) with the cognitive style on the perceptual field (independence) leads to a significant increase in usability among students, with no interaction between them.

Based on the previous result, hypothesis number (6) was rejected, meaning that:" There are no statistically significant differences at the significance level ($\alpha \geq 0.05$) between the mean scores of the four experimental groups due to the interaction effect between adaptive navigation styles (link hiding – direct routing) and cognitive style on the perceptual domain (independence – dependence) in the e-learning environment on usability."

4.8. Discussion

The preceding analysis has provided a comprehensive exploration of the study the effect of different adaptive navigation methods (link hiding - direct routing) and cognitive style on the perceptual domain (independence - dependence) in reducing digital stress and increasing students' Usability the e-learning environment. Through a critical examination of the statistical results and consideration of the broader context, this discussion seeks to contribute to an understanding of how combining adaptive navigation techniques and a cognitive learner's approach can reduce digital stress and increase receptiveness to the use of online educational sites, providing valuable insights for teachers, researchers, and education practitioners.

The main aim of this study was to study the effect of different adaptive navigation methods (link hiding - direct routing) and cognitive style on the perceptual domain (independence - dependence) in reducing digital stress and increasing students' Usability the e-

learning environment. Various instructional design models were reviewed to select the optimal phases for conducting the research experiment, including analysis, design, production, evaluation, and implementation. This aimed to study learner characteristics, formulate content and activity objectives, and implement the research experiment. The Digital Stress Reduction and Acceptance Scale was administered to the research sample of students post-tested, and the results indicated that using adaptive navigation methods (direct routing) with the cognitive style (independence) in the e-learning environment reduces digital stress among students, while also fostering interaction between them, And Using adaptive navigation techniques (hiding links) with the cognitive style (independence) increases student acceptance of the use, with no interaction between them.

Researchers attribute this result to the fact that direct routing significantly reduces digital stress, as it provides clear and explicit steps, eliminating the need for excessive thinking or searching for information. link hiding can be used for secondary or optional sections, while direct routing focuses on core content and critical steps for the user. link hiding requires the user to remember the link's location or explore the content to access it, which increases cognitive load, especially when navigating long or complex pages. Direct routing allows the user to quickly access the required content, while link hiding may make the user spend more time searching for information, which leads to distraction and increased psychological fatigue. while link hiding offer greater flexibility, they also increase cognitive effort and digital fatigue. Direct navigation provides a clearer and more effective experience, especially on educational websites with lengthy or complex content, and significantly improves both learning and user experience.

Navigation Flexibility and Personal Control : link hiding provide users with a higher degree of freedom to choose their own path within the website, without feeling guided or obliged to follow a predetermined sequence. In contrast, direct routing can be restrictive in some cases, as it requires users to adhere to specific steps, which may reduce their sense of autonomy and self-directed control over the learning process. On long or educational pages, hidden links reduce visual clutter compared to direct links, which can occupy a large portion of the screen with visual elements and indicators. Users sometimes prefer clean interfaces with options that appear only when needed, which enhances site acceptance and usability. Educational websites that use hidden links allow users to design their own learning path and choose the order that suits them, increasing user satisfaction and acceptance. Direct routing is useful for providing a clear structure, but it may reduce the sense of independence in learning.

5. CONCLUSION

In conclusion, this research illuminates the profound influence of the effectiveness of combining the type of different adaptive navigation methods (link hiding - direct routing) and cognitive style on the perceptual domain (independence - dependence) in reducing digital stress and increasing students' Usability the e-learning environment. To achieve this goal, a digital assessment environment was applied to the research sample, which consisted of (80) first-year students from the Department of Educational Technology and Computer Science at the Faculty of Specific Education, Kafr El-Sheikh University. They were distributed into four main groups, each group consisting of (20) students.

A group that uses adaptive navigation techniques (hiding links) and the cognitive style (independence), a group that uses adaptive navigation techniques (direct routing) and the cognitive style (independence) , a group uses adaptive navigation techniques (link hiding) and the cognitive approach (dependency), while another group uses adaptive navigation techniques (direct routing) and the cognitive approach (dependency) when using electronic tests, according to the variables of the current research. The Digital Stress Reduction and Acceptance Scale was administered to the research sample of students post-tested.

This research ultimately concludes that by using This research finally concludes that by applying indicated that using adaptive navigation methods (direct routing) with the cognitive style (independence) in the e-learning environment reduces digital stress among students, while also fostering interaction between them, And Using adaptive navigation techniques (hiding links) with the cognitive style (independence) increases student acceptance of the use, with no interaction between them.

5.1. Recommendations And Further Research:

Improving the design of educational websites to combine direct guidance for beginners with hidden links for advanced learners, to achieve a balance between ease of use and learning independence.

Developing navigation aids such as progress bars and shortcut links to reduce cognitive load and digital stress.

Tailoring the learning experience to the cognitive styles of users, so that sites support cognitively independent users in a different way than cognitively dependent users.

Exploring the relationship between guidance and new digital learning styles such as adaptive learning and artificial intelligence.

Employing user behavior analytics to understand how students interact with hidden links and direct guidance, and using this data to improve the design of the learning experience.

Integrating intelligent content personalization so that links or instructions are displayed according to the learner's level of experience or cognitive style, to promote independence and achieve effective learning.

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