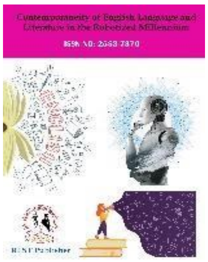
Contemporaneity of Language and Literature in the Robotized Millennium
Vol: 2(2), June 2023
REST Publisher; ISSN: 2583-7370 (Online)
Website: http://restpublisher.com/journals/cellrm/
DOI: https://doi.org/10.46632/cellrm /2/2/2



A Review on Human–Computer Interaction Education Based on Active Learning using the DEMATEL Method

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Abstract: *The objective of the study was to explore how web lectures could be used to enhance the learning experience in an introductory human-computer interaction course. The researchers introduced web lectures as a method to deliver lecture material prior to class, allowing more interactive learning activities during in-class sessions instead of passive listening. A quasi-experiment was conducted over a 15-week semester, involving 46 students who were divided into two sections of the same course. One section utilized web lectures, while the other followed traditional lectures. To ensure fairness, several control measures were implemented, including the same instructor for both sections and blind grading. The findings revealed that the section using web lectures achieved significantly better grades compared to the section with traditional lectures. Moreover, students in the web lecture section reported increasingly positive attitudes towards this approach throughout the course. This research provides a twofold contribution: firstly, it demonstrates a new way of utilizing existing technology to enhance learning outcomes, and secondly, it presents a comprehensive, quasi-experimental evaluation of web lectures in the specific context of the course. Various undergraduate courses incorporate the field of human-computer interaction (HCI) and emphasize a theoretical approach that encompasses the entire process of creating effective interfaces for end users. However, instructors encounter difficulties in keeping students engaged during the introduction of these concepts and encouraging practical experience in HCI. The aim of this study is to propose a teaching and learning method that enhances student retention and promotes a deeper understanding of HCI. This method consists of two components. The first part focuses on explaining the theoretical concepts of the discipline, while the second part involves implementing problem-based learning (PBL) within The DEMATEL method involves a systematic process of analyzing the relationships between different factors or variables in a system. It aims to uncover the cause-and-effect chains and understand the influence and impact each factor has on others. By employing DEMATEL, decision-makers can gain insights into the interdependencies among factors and determine which components play a significant role in shaping the system's behaviour. This method facilitates a comprehensive evaluation of the relationships, allowing for a more informed decision-making process. This model provides a clear representation of the complex system, highlighting the critical components and their influence on other factors. By visualizing and understanding the cause-effect chains, decision-makers can make informed choices and develop effective strategies for system improvement. Stability (ST), Speed (SP), System integration (SI), Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS) Human–Computer Interaction Education Based on Active Learning Methods IWS is got the first rank whereas is the system integration is having the lowest rank. Human–Computer Interaction Education Based on Active Learning Methods IWS is got the first rank whereas is the system integration is having the lowest rank.*

Keywords: *Human computer interaction, independent, learning management, Web,*

1. INTRODUCTION

This research examines the usage of Web lectures, which consist of audio, video, and PowerPoint materials produced using Microsoft Producer. The objective is to provide information in advance, outside of the classroom, to help students prepare for more engaging and beneficial in-class activities. Web lectures are concise recordings that usually range from 15 to 25 minutes in length, covering a similar amount of material as a 30 to 50-minute traditional lecture. The intentional shorter duration aims to maintain viewer focus and omits administrative announcements, digressions by the instructor, and student queries that may arise during a typical lecture. This exploration encompasses both teaching methods (pedagogy) and technology. The focus is on finding effective approaches to motivate students to watch online lectures before class, similar to the challenge of getting them to read assigned materials in advance. One technique involves having students prepare presentations in class based on the online lecture content. Another approach is to assign homework that relies on the information presented in the online lectures. Additionally, it is important to determine the most effective types of activities to complement the online lectures during class time. The goal is to utilize the freed-up class time for engaging students in meaningful activities rather than simply repeating the content covered in the online lectures. One objective of this research is to make theoretical courses more appealing to students, leading to better knowledge retention. To achieve this, the project management (PM) approach incorporates project-based learning, as demonstrated in a previous study [7]. In this approach, students collaborate to solve problems and transform traditional lecture-based instruction into project-based learning. In another study [8], college students used mental models to represent a learning object (LO) designed for interactive digital television (IDTV). These mental models effectively highlighted various elements, such as behaviour and space, which students typically perceive, thus determining the key elements involved in communication between developers and users. In the current study, these elements were utilized during the workshop to create Learning Object-based Interactive Videos (LOBIVs) and played a significant role in keeping students focused on the fundamental concepts of the nested context language (NCL) [2].HCI, a crucial component of computer science degree programs, involves the design, assessment, and implementation of interactive computer systems for human utilization. According to Hewett et al. (1992), it also encompasses the examination of significant phenomena related to these systems. HCI is an interdisciplinary field that combines technical approaches from computer science with social methodologies. The survey conducted by Churchill, Bowser, and Preece (2013) involving researchers, practitioners, and educators from different continents revealed a wide range of core issues in HCI, including social media, natural language processing, social network analysis, and robotics. ACM SIGHCI has identified three main aspects to guide HCI curricula [3].The current limitation of web pages primarily consisting of simple graphical elements and static teaching materials makes it difficult to create a realistic teaching environment with dynamic interaction. Nonetheless, the integration of three-dimensional scenes through the VRML language allows the simulation of genuine teaching scenarios on web pages. Computer-aided instruction (CAI), a significant component of computer-aided education (CBE), utilizes computer functionalities to enhance student learning. VRML theory offers platform independence and is widely adopted for computer assembly experiments in teaching. In the context of computer assembly education, VRML-based experiments with a certain level of interaction play a crucial role in helping students understand the fundamental process of unit loading. The cognitive theory suggests that reading single screens of text in hypertext systems does not involve different cognitive processes compared to reading printed text on paper. The distinction lies in the network of links that connect different nodes within the hypertext system, offering diverse possibilities for system interface and link identities. The question is whether these links provide benefits to the learner and whether the specific structure of the hypertext system influences the learning experience [5].Visual education utilizes human-computer interaction to present educational materials in a visual format (Source: [4]. The effectiveness of human-computer interaction systems for visual education relies on user-friendliness, simplicity, and an intuitive interface with multiple functionalities (Source: [5]). These systems enhance interactivity and operability, which are vital for visual education (Source: [6]). High-performance computer systems provide computational power to create innovative learning environments. Future learning technologies should accommodate various environments, ranging from open-ended, user-centered systems to guided, teacher-centered tutoring environments. Rather than solely pursuing artificial intelligence and autonomous machines, the development of joint human-computer cognitive systems, where computers amplify cognitive abilities, is a significant objective [7] When designing websites, different patterns can be used, including Forms and Controls, (MVC), (MVVM), and Model-View-Presenter In the context of website development, MVP has been identified as a suitable pattern due to its comprehensive control system, making testing easier and enabling the reuse of solutions To assess the quality of a website, the quality function deployment (QFD) approach can be employed. This involves gathering user opinions at each stage of development or implementation, and the Equal framework is commonly used for website quality determination. The adoption of Building Information Modeling (BIM) in (AEC) industry has increased the importance of incorporating BIM-related instruction in Construction programs. With limited class time and numerous available applications and hardware, careful selection of BIM tools is crucial to enhance the student learning experience.

2. MATERIALS AND METHOD

2.1. Stability (ST): Stability (ST) refers to the state of being firm, secure, or unchanging. It indicates the ability of an object, system, or situation to maintain its balance, equilibrium, or overall condition over time. In various contexts, stability can refer to different aspects such as physical stability, emotional stability, financial stability, political stability, or stability within a particular system or structure. It implies a state of reliability, consistency, and resistance to disturbances or disruptions, allowing for predictability and continuity

2.2. Speed (SP): Speed, commonly represented as SP, refers to the rate at which an object or individual moves or covers a distance. It is a measure of how quickly something travels from one point to another. Speed is typically quantified in units such as miles per hour (mph). In physics, speed is considered a scalar quantity, meaning it only has magnitude and does not have a specific direction associated with it.

2.3. System Integration: It involves integrating various software, hardware, and network components to ensure they work together seamlessly and effectively. System integration aims to create a unified solution that maximizes the efficiency, functionality, and interoperability of the different subsystems within an overall system. This process typically involves planning, designing, implementing, and testing the integration of different systems to achieve a smooth and integrated operation. SI is commonly employed in various industries and sectors to streamline processes, enhance productivity, and improve overall system performance.

2.4. Aesthetic Visualization (Av): is a concept that involves the use of visual imagery to create an aesthetic experience or appeal. It refers to the process of mentally or visually representing something in a way that is pleasing, beautiful, or visually appealing. Aesthetic visualization can be used in various fields, including art, design, architecture, and even personal development. In art and design, aesthetic visualization often involves creating or imagining visual compositions, colour schemes, or arrangements that are visually appealing or evoke certain emotions or moods. It can also refer to the practice of envisioning or mentally visualizing a desired outcome or final result before starting a creative project. In personal development or self-improvement, aesthetic visualization techniques are sometimes used to create mental images of desired goals or outcomes. By visualizing these goals in a vivid and aesthetically pleasing way, individuals can enhance motivation, focus, and belief in achieving their objectives. Overall, aesthetic visualization combines the power of visualization techniques with an emphasis on creating visually pleasing or aesthetically appealing representations. It can be a valuable tool for artists, designers, and individuals seeking to enhance their creative processes or manifest their aspirations.

2.5. Friendliness other learner (UF): Being friendly towards other learners (UF) involves treating them with kindness, respect, and empathy. It means creating a positive and supportive environment where everyone feels comfortable and encouraged to participate. This can be done by actively listening to their ideas, offering constructive feedback, and providing assistance when needed. Friendliness towards other learners also involves being patient and understanding, as everyone learns at their own pace and may have different perspectives or experiences. By fostering a friendly atmosphere, we can promote collaboration, mutual growth, and a sense of community among learners.

***2.6. An interactive GUI (Graphical User Interface)*:** Interactive GUIs are commonly used in a wide range of applications, including computer programs, mobile apps, websites, and electronic devices. They enhance user experience by providing a visual representation of the system and enabling users to interact with it in a more intuitive and efficient manner. Interface

2.7. flexibility (IF): refers to the ability of an interface or system to adapt and accommodate changes in requirements, configurations, or user preferences without requiring significant modifications or disruptions. It implies that the interface can be easily adjusted or customized to meet varying needs or conditions, providing users with a versatile and adaptable user experience.

2.8. User interaction with IWS (Interactive Writing System): typically involves a series of back-and-forth exchanges between the user and the system. The user provides input or prompts in the form of text, and the IWS generates a response based on the given input. The interaction can vary depending on the specific capabilities and design of the IWS. For example, the user may ask a question, request information, seek clarification, or seek assistance with a particular task. The IWS then analyzes the input, processes the information, and generates a relevant and coherent response. The IWS may use a combination of techniques, such as natural language understanding, machine learning, and pattern recognition, to understand the user's input and generate an appropriate response. It may also access a vast knowledge base or database of information to provide accurate and helpful answers. The goal of the user interaction with IWS is to facilitate effective communication and provide valuable assistance or information to the user. The human-computer interface, as defined in 1994, pertains to the point at which the application and the end user interact. Within an educational setting, it enables the learner to engage with the computer and vice versa. This interactive communication is made possible through both the hardware interface Evaluating project groups reveals that highly successful groups meet all specified evaluation criteria outlined in the templates. They provide thorough explanations for each project component and actively participate in weekly group discussions, resulting in comprehensive project outcomes. Feedback from the lecturer and assistant team is carefully considered by these high-performing groups, who make necessary adjustments to their prototypes to ensure proper implementation of interaction design principles. Moreover, their prototypes are user-friendly and fulfill all user requirements. The combination of limited computer experience and experimental techniques can place a significant burden on processing capacity, which may be further exacerbated by age-related declines in processing capacity.The detection of facial emotions holds significant importance in communication, and it has various practical applications. These applications encompass areas such as assessing customer satisfaction, supporting criminal justice systems, facilitating e-learning, enhancing security monitoring, enabling social robots, and improving smart card applications. The conventional system for recognizing emotions typically consists of three key components: face detection, feature extraction, and emotion classification. In Interactive Machine Learning (IML) systems, user goals can be broadly categorized into two types: task completion and model building. Task completion-focused systems assume that users have knowledge about the task but may not possess expertise in machine learning. Assessment in IML systems is an ongoing process aimed at providing meaningful feedback to support and enhance learning. The tutor's role is crucial in delivering appropriate feedback that facilitates students' learning. The current study aims to evaluate students' experiences with self-assessment, peer assessment, and group assessment in a Problem-Based Learning (PBL) tutorial setting.. The researchers focused on the active/reflective scale in this study, which relates to how learners interact with different types of supportive information. To streamline the grading process and provide prompt feedback, a blended assessment approach using Wiley Plus and MOODLE was implemented in the statistics course, reducing teachers' workload and enabling immediate feedback for students**.**

3. RESULTS AND DISCUSSION

TABLE 1. Human–Computer Interaction Education Based on Active Learning Methods

	ST	**SP**	**SI**	**AV**	**UF**	**IG**	**IF**	**IWS**	**Sum**
ST	0.05	2.53	1.53	2.54	2.09	2.67	1.55	2.84	15.81
SP	0.10	1.40	1.90	1.33	2.05	2.14	1.00	2.44	11.36
SI	2.00	2.09	2.27	2.09	1.00	0.99	2.33	2.56	13.00
AV	1.68	1.23	1.54	2.66	2.58	1.98	1.05	2.58	14.25
UF	1.18	1.81	2.45	1.18	2.45	3.00	1.54	1.55	13.62
IG	1.81	1.94	2.45	2.80	3.00	1.22	2.58	2.96	16.18
IF	1.90	2.00	2.27	2.54	3.00	3.00	0.00	2.27	16.98
IWS	1.54	1.55	1.90	2.50	2.75	3.00	2.27	2.63	15.87

Table 1 shows that DEMATEL Decision making trail and evaluation laboratory in Human–Computer Interaction Education Based on Active Learning Methods with respect to Stability (ST), Speed (SP), System integration (SI),Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS)

TABLE 2 Normalization of direct relation matrix

Normalization of direct relation matrix								
	ST	**SP**	**SI**	**AV**	**UF**	**IG**	**IF**	**IWS**
ST	0.008963	0.422417	0.2555	0.423333	0.347833	0.445	0.258333	0.473333333
SP	0.016667	0.233333	0.316667	0.221667	0.341667	0.356667	0.166667	0.406666667
SI	0.333333	0.348333	0.378333	0.348333	0.166667	0.165	0.388333	0.426666667
AV	0.28	0.205	0.256667	0.443333	0.43	0.33	0.175	0.43
UF	0.196667	0.301667	0.408333	0.196667	0.408333	0.5	0.256667	0.258333333
IG	0.301667	0.323333	0.408333	0.466667	0.5	0.203333	0.43	0.493333333
IF	0.316667	0.333333	0.378333	0.423333	0.5	0.5	0	0.378333333
IWS	0.256667	0.258333	0.316667	0.416667	0.458333	0.5	0.378333	0.438333333

Table 2 shows that the Normalizing of the direct relation matrix in Human–Computer Interaction Education Based on Active Learning Methods to Stability (ST), Speed (SP), System integration (SI),Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS).

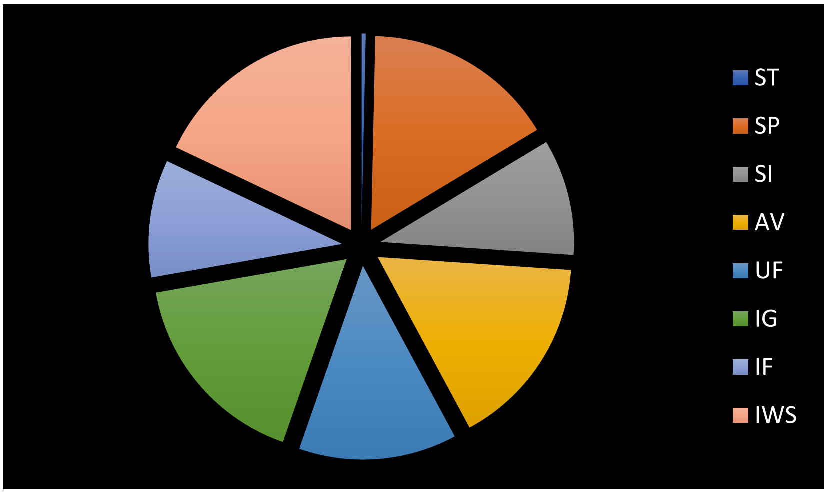

FIGURE 1. Normalization of direct relation matrix

Figure 1 shows that chart for Normalizing of direct relation matrix in Human–Computer Interaction Education Based on Active Learning Methods to Stability (ST), Speed (SP), System integration (SI),Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS) has Different value.

TABLE 3. Calculate the Total Relation Matrix

	ST	**SP**	**SI**	**AV**	**UF**	**IG**	**IF**	**IWS**
ST	0.008963333	0.422416667	0.2555	0.423333333	0.347833333	0.445	0.258333333	0.473333333
SP	0.016666667	0.233333333	0.316666667	0.221666667	0.341666667	0.356666667	0.166666667	0.406666667
SI	0.333333333	0.348333333	0.378333333	0.348333333	0.166666667	0.165	0.388333333	0.426666667
AV	0.28	0.205	0.256666667	0.443333333	0.43	0.33	0.175	0.43
UF	0.196666667	0.301666667	0.408333333	0.196666667	0.408333333	0.5	0.256666667	0.258333333
IG	0.301666667	0.323333333	0.408333333	0.466666667	0.5	0.203333333	0.43	0.493333333
IF	0.316666667	0.333333333	0.378333333	0.423333333	0.5	0.5	0	0.378333333
IWS	0.256666667	0.258333333	0.316666667	0.416666667	0.458333333	0.5	0.378333333	0.438333333

Table 3 Shows the Calculate the total relation matrix in Human–Computer Interaction Education Based on Active Learning with respect to Stability (ST), Speed (SP), System integration (SI),Aesthetic visualization (Av),

Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS) is Calculate the Value.

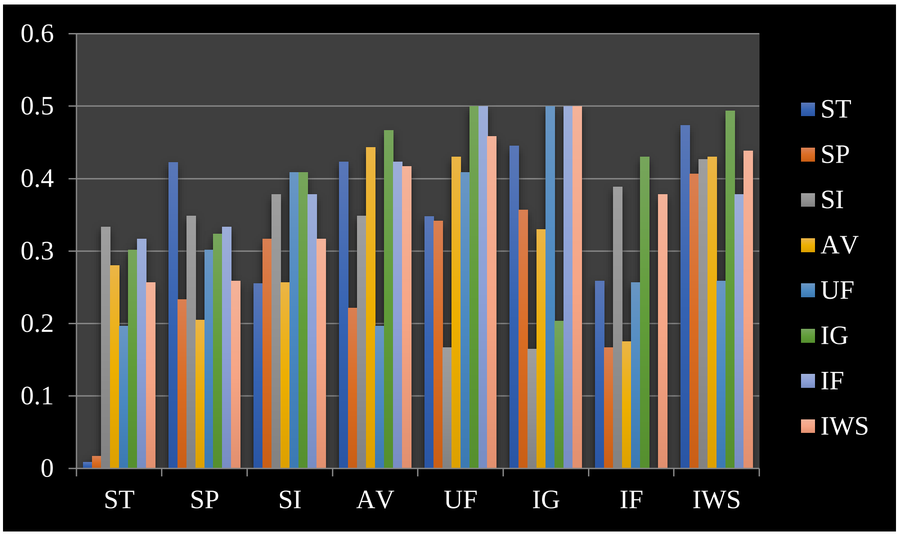

FIGURE 2. Total relation matrix

Figure 2 Shows the Calculate the total relation matrix in Human–Computer Interaction Education Based on Active Learning with respect to Stability (ST), Speed (SP), System integration (SI), Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS) is Calculate the Value.

TABLE 4 T= Y(I-Y)-1, I= Identity matrix

I= Identity matrix							
ST	**SP**	**SI**	**AV**	**UF**	**IG**	**IF**	**IWS**
1	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0
0	0	1	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0
0	0	0	0	0		1	0
0	0	0	0	0	0	0	1

Table 4 Shows the T= Y(I-Y)-1, I= Identity matrix in matrix in Human–Computer Interaction Education Based on Active Learning with respect to Stability (ST), Speed (SP), System integration (SI),Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS) is common Value.

TABLE 5 Y Value

Y							
ST	**SP**	**SI**	**AV**	**UF**	**IG**	**IF**	**IWS**
0.008963	0.422417	0.2555	0.423333	0.347833	0.445	0.258333	0.473333
0.016667	0.233333	0.316667	0.221667	0.341667	0.356667	0.166667	0.406667
0.333333	0.348333	0.378333	0.348333	0.166667	0.165	0.388333	0.426667
0.28	0.205	0.256667	0.443333	0.43	0.33	0.175	0.43
0.196667	0.301667	0.408333	0.196667	0.408333	0.5	0.256667	0.258333
0.301667	0.323333	0.408333	0.466667	0.5	0.203333	0.43	0.493333
0.316667	0.333333	0.378333	0.423333	0.5	0.5	0	0.378333
0.256667	0.258333	0.316667	0.416667	0.458333	0.5	0.378333	0.438333

Table 4 Shows the Y Value in Human–Computer Interaction Education Based on Active Learning with respect to Stability (ST), Speed (SP), System integration (SI),Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS) is Calculate the total relation matrix Value and Y Value is the same value.

TABLE 6. I-Y Value

I-Y							
ST	**SP**	**SI**	**AV**	**UF**	**IG**	**IF**	**IWS**
0.991037	-0.42242	-0.2555	-0.42333	-0.34783	-0.445	-0.25833	-0.47333
-0.01667	0.766667	-0.31667	-0.22167	-0.34167	-0.35667	-0.16667	-0.40667
-0.33333	-0.34833	0.621667	-0.34833	-0.16667	-0.165	-0.38833	-0.42667
-0.28	-0.205	-0.25667	0.556667	-0.43	-0.33	-0.175	0.57
-0.19667	-0.30167	-0.40833	-0.19667	0.591667	-0.5	-0.25667	-0.25833
-0.30167	-0.32333	-0.40833	-0.46667	-0.5	0.796667	-0.43	-0.49333
-0.31667	-0.33333	-0.37833	-0.42333	-0.5	-0.5	1	-0.37833
-0.25667	-0.25833	-0.31667	-0.41667	-0.45833	-0.5	-0.37833	0.561667

Table 6 Shows the I-Y Value in Human–Computer Interaction Education Based on Active Learning with respect to Stability (ST), Speed (SP), System integration (SI),Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS) table 4 T= Y(I-Y)-1, I= Identity matrix and table 5 Y Value Subtraction Value.

TABLE 7. (I-Y)-1 Value

(I-Y)-1							
ST	**SP**	**SI**	**AV**	**UF**	**IG**	**IF**	**IWS**
0.648039018	-0.14259	-0.34136	-0.20823	-0.29407	-0.18523	-0.19298	-0.03305
-0.27805729	0.761477	-0.19448	-0.32584	-0.24	-0.18528	-0.17837	0.106678
-0.061190047	-0.15433	0.762545	-0.22065	-0.49578	-0.40794	-0.08915	-0.00652
0.096089048	0.074985	0.078519	1.173775	0.123667	-0.01063	-0.07856	-1.00165
-0.208068453	-0.25307	-0.22582	-0.48375	0.668951	-0.18972	-0.18738	-0.02436
-0.158563684	-0.29475	-0.3158	-0.27753	-0.30077	0.521829	-0.14565	-0.08338
-0.125251775	-0.23257	-0.27677	-0.26159	-0.24514	-0.20168	0.581838	-0.11669
-0.190281308	-0.37186	-0.4091	-0.31669	-0.31953	-0.23387	-0.16941	0.894941

Table 7 shows the (I-Y)-1Value in Human–Computer Interaction Education Based on Active Learning with respect to Stability (ST), Speed (SP), System integration (SI),Aesthetic visualization (Av), Friendliness other learner (UF), interactive GUI(IG), interface flexibility (IF), User interaction with (IWS) Table 6 shows the Minvers shows used.

TABLE 8. Total Relation matrix (T)

Total Relation matrix (T)							
-0.351960982	-0.14259	-0.34136	-0.20823	-0.29407	-0.18523	-0.19298	-0.03305
-0.27805729	-0.23852	-0.19448	-0.32584	-0.24	-0.18528	-0.17837	0.106678
-0.061190047	-0.15433	-0.23746	-0.22065	-0.49578	-0.40794	-0.08915	-0.00652
-0.094192261	-0.29687	-0.33058	-0.14292	-0.19587	-0.2445	-0.24797	-0.10671
-0.208068453	-0.25307	-0.22582	-0.48375	-0.33105	-0.18972	-0.18738	-0.02436
-0.158563684	-0.29475	-0.3158	-0.27753	-0.30077	-0.47817	-0.14565	-0.08338
-0.125251775	-0.23257	-0.27677	-0.26159	-0.24514	-0.20168	-0.41816	-0.11669
-0.190281308	-0.37186	-0.4091	-0.31669	-0.31953	-0.23387	-0.16941	-0.10506

Table 8 shows the Total Relation Matrix (T) the direct relation matrix is multiplied by the inverse of the value that the direct relation matrix is subtracted from the identity matrix.

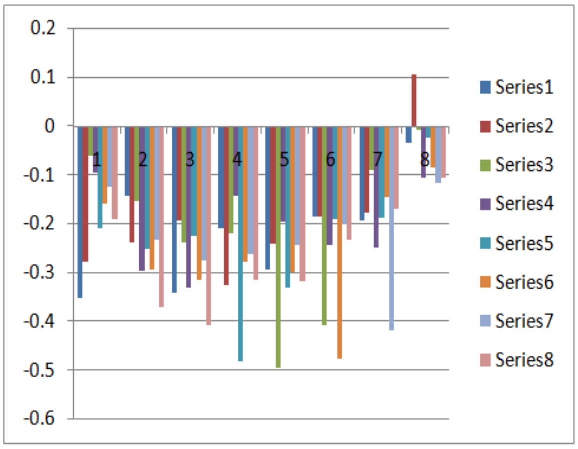

FIGURE 4. Total Relation Matrix (T)

Figure 4. Shows the Total Relation Matrix (T) the direct relation matrix is multiplied with the inverse of the Value that the direct relation matrix is subtracted from the identity matrix.

TABLE 9 Ri and Ci value

Ri	**Ci**
-1.74946	-1.46757
-1.53387	-1.98455
-1.67302	-2.33136
-1.65961	-2.2372
-1.90322	-2.4222
-2.05461	-2.12638
-1.87784	-1.62908
-2.1158	-0.36908

Table 9 shows the Ri, Ci Value Human–Computer Interaction Education Based on Active Learning.

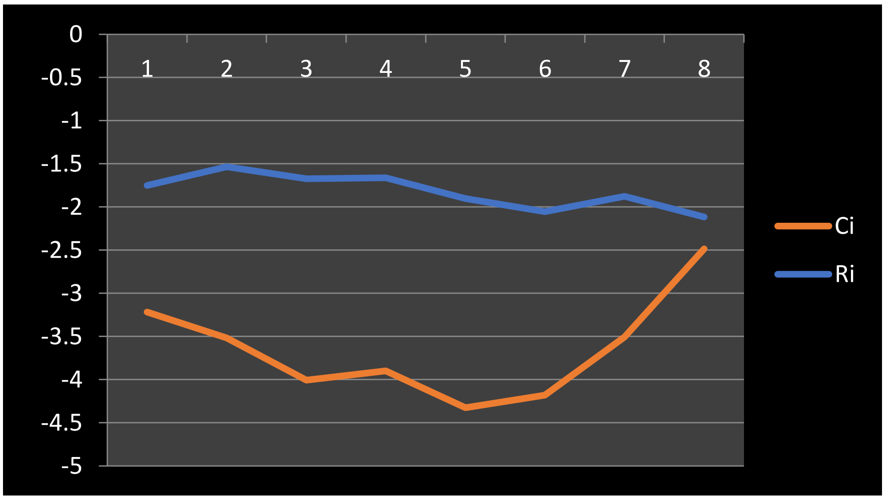

FIGURE 4. Total Relation Matrix (T) Ri, Ci Value

Figure 4 shows the Ri, Ci Value Human–Computer Interaction Education Based on Active Learning.

TABLE 10. Calculation of Ri+Ci and Ri-Ci To Get The Cause And Effect

Ri+Ci	Ri-Ci	Identity	Rank
-3.21702	-0.28189	cause	2
-3.51842	0.450684	effect	4
-4.00438	0.658349	effect	6
-3.8968	0.577592	effect	5
-4.32542	0.518982	effect	8
-4.18099	0.071776	effect	7
-3.50692	-0.24876	cause	3
-2.48488	-1.74673	cause	

Table 10 shows the Calculation of Ri+Ci and Ri-Ci to Get the Cause and Effect.

TABLE 11. T matrix value

T matrix							
-0.35196	**-0.14259**	-0.34136	**-0.20823**	-0.29407	**-0.18523**	**-0.19298**	**-0.03305**
-0.27806	-0.23852	-0.19448	-0.32584	-0.24	**-0.18528**	**-0.17837**	**0.106678**
-0.06119	**-0.15433**	-0.23746	-0.22065	-0.49578	-0.40794	**-0.08915**	**-0.00652**
-0.09419	-0.29687	-0.33058	**-0.14292**	-0.19587	-0.2445	-0.24797	**-0.10671**
-0.20807	-0.25307	-0.22582	-0.48375	-0.33105	**-0.18972**	**-0.18738**	**-0.02436**
-0.15856	-0.29475	-0.3158	-0.27753	-0.30077	-0.47817	**-0.14565**	**-0.08338**
-0.12525	-0.23257	-0.27677	-0.26159	-0.24514	**-0.20168**	-0.41816	**-0.11669**
-0.19028	-0.37186	-0.4091	-0.31669	-0.31953	-0.23387	**-0.16941**	**-0.10506**

Table 11. Shows the T matrix calculate the average of the matrix and its threshold value (alpha) **Alpha-0. 2262** If the T matrix value is greater than threshold value then bold it.

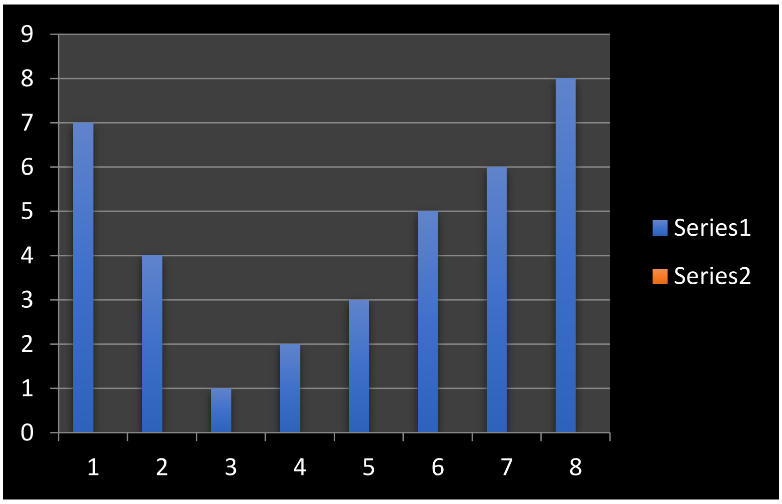

FIGURE 5. Shown the Rank

Figure 5 show the Rank using the DEMATEL for Human–Computer Interaction Education Based on Active Learning Methods IWS is got the first rank whereas is the system integration is having the lowest rank.

4. CONCLUSION

The main objective of the research is to investigate the potential application of Human-Computer Interaction (HCI) in the management of mathematics classes. Specifically, the study focuses on exploring HCI modes that can be advantageous for teaching construction-related concepts within educational settings that utilize Building Information Modeling (BIM) applications. By integrating interactive display technologies, the study anticipates a significant enhancement in students' educational experiences through visual and interactive teaching methods. However, it acknowledges that experimental research in HCI often involves participant groups that are not representative of the broader population, typically consisting of young, technically proficient, and highly educated individuals. To address this limitation and achieve a more inclusive representation of society, the study proposes the inclusion of older adults in research groups. However, obtaining high-quality data from these participants necessitates modifications to research methods and organization. Additionally, the research introduces the concept of interactive machine teaching (IMT), which involves developing machine-learned models that are both semantically meaningful and capable of being debugged**.**

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