

The impact of human-computer interaction on innovations and sports psychology

Mishal Sohail¹, Muhammad Talha¹, Munib Ali¹

Abstract

This study's major objective is to examine the impact of human-computer interaction on innovation and sports psychology. This research study utilized questions linked to independent and dependent variables based on primary data analysis to assess the research. This research study on human-computer interaction conducted in China also discusses innovation and sports psychology. Human-computer interaction is the primary independent variable; it encompasses computer science, cognitive science, and human factor engineering, all regarded as independent variables. Innovation and sports psychology are viewed as dependent factors. This research is based on original data from assessing the outcome with intelligent PLS software and generating useful results. The correlation, R-square, F-square values, and weighted average analysis illustrate the intelligent PLS Algorithm model. The overall findings indicate that human-computer interaction has a favorable and significant effect on innovation and sports psychology. Computer science has direct effects on sports psychology as well. Cognitive science has a close relationship with innovation and sports psychology.

Keywords: Human-computer Interaction (HCI), Innovation (INN), Sport Psychology (SP), Computer Science (CS), cognitive science (CS), Human factor engineering (HCE)

Research Type: Research Paper

Introduction

The rapid increase in technology-based products worldwide is due to immense advancements in science and technology. All industrialized nations are advanced as a result of their contemporary technologies. The globe has produced several technological devices, such as computers, cell phones, and televisions, to offer its citizens the benefits of technology. Numerous technologists have developed intelligent software. The most well-known piece of software is artificial intelligence. These software programs are intelligent and capable of adapting their results to a given circumstance. Humans are the ones who profit the most from technological progress. The man may do incredible feats with the aid of technology products. Technology is employed in every aspect of life (Talha, Sohail, et al., 2020). Education and sports in the contemporary world are dependent on technology. Students in both sports and education can benefit from using technology to enhance sports and education (Zhou et al., 2021). Additionally, modern technology has both benefits and drawbacks. Nevertheless, it is up to those who utilize technology to determine whether they will use it to create miracles or to destroy the world.

There is a deep connection between humans with computers. Human-computer interaction is based on developing computer technology that aims to increase the influence of technology on humans. Human-computer interaction is a concept that is based on providing the users with technological products that are user-friendly. Artificial intelligence is the most

significant technological development resulting from human-computer interaction (Balcombe & De Leo, 2022). Artificial intelligence can identify and predict solutions to a variety of issues. The primary benefit of artificial intelligence is that it can forecast a person's mental health and prevent suicide by guiding them in the right direction. Artificial intelligence technology is currently available on all smartphones. Smartphones provide an app that utilizes artificial intelligence for self-guide. Therefore, the primary objective of human-computer interaction is to give technology-based services to humans to ameliorate the global population's mental health issues. The human-computer interaction is directly linked with innovation and advancement. When human interacts with the computer, a new technology-based program is formed. This new technology-based program helps in making innovation possible. In today's world, innovation is very important. Innovation in all the fields of science can be made with the help of human-computer interaction (Liu et al., 2021).

Consequently, human-computer interaction to develop software solutions that help humans in sports is crucial. The primary objective of such engagement is to digitalize sports training across all sports fields. Numerous technologically-based systems have been developed to recognize various athletic moves and body language in recent years. These applications can recognize and sense moving targets in sports using artificial intelligence. The traditional and old sports training methods have been replaced with the new and

^{1,2,3} Department of Computer Science, Superior University Lahore, Pakistan
Corresponding author email: talhashoibt@yahoo.com

modern training programs based on intelligence systems. The human-computer interaction provides innovation and advancement in sports and helps various sports be recognized internationally.

Sports of all kinds hold a great significance in the world of today. Many people worldwide play sports and like to watch sports of various kinds for entertainment. Sports are a source of physical exercise. It has many benefits. Sports help and make people healthier and more energetic. As the world is advancing, people all over the globe like to watch and play sports based on new and modern technology (Talha, Azeem, et al., 2020). Different instructors instruct their players solely on the game's strategies. Nevertheless, the employment of advanced technology programs in sports not only instructs the participant about the activity, but also detects their movements so that they can enhance their body movements for the following game. The most important aspects of any activity are the detection of improper movement of body parts and the improvement of a movement. This can only be accomplished with the use of the artificial intelligence program. One more important function of artificial intelligence technology is to detect the player's behavior and mental state while playing (Nurja et al., 2022). If the player is mentally fit, he will be able to play. Otherwise, he will be thrown out of a particular sport. So, to be a part of any sport, a player needs to be mentally strong.

Understanding of sports psychology is made using advanced technology. Only modern technology can detect the psychological state of the player of sports. Many universities offer sports psychology courses for sports players to understand various sports (Gill et al., 2021). The old methods of sports training are very boring. Sports techniques are innovated using modern technology to add new life to the boring sports tradition. Therefore, innovation is a must in the modern world, and it can only be realized through the use of cutting-edge technology (John M. York, 2022).

Additionally, sports are crucial in the modern environment since they provide a means of physical activity. Sports-related physical exercise improves the health of athletes and helps them maintain a healthy lifestyle. Therefore, participation in sports should be encouraged in every region globally to promote physical education. The governments of all states should make physical education and participation in various sports mandatory for all students (Gardner, 2021).

Research objective

The main objective of the research paper is to find out the role of human-computer interaction in innovation. This article has also discussed the effect of human-computer interaction programs on sports psychology. This research study describes five portions: the first section represents the introduction related to the effect of human-computer interaction on innovation and sports psychology. This section describes the research

objective and presents the research questions and measurements of the research study. The second part presents the previous research study of variables, and the third represents the research methodology. This portion presents the theoretical framework and describes the independent and dependent variables. The fourth section presents the results and descriptions of this research represent different informative results. The last section summarized the overall research study and described the conclusion of the research.

Literature Review

As a result of the development of science and technology, the computer has become an essential component of daily life. Ren and Bao (2020) define HCI as studying computers, people, and interactions. The synergistic flow of knowledge and information between a computer system and humans regarding numerous behaviors, activities, and symbols. It was asserted that the computer had become an integral element of modern life with the advancement of technology. Therefore, HCI human-computer interaction is necessary for innovation and to satisfy the needs and demands of the present world. In addition, Bateman et al. (2011) offered an investigation of the effects of HCI on modern sports psychology and technological innovation.

Human-computer interactions positively promote invention, as determined by a questionnaire survey that collected sample data. It was advantageous for the sports industry to store and properly manage data. It was also beneficial for increasing athletic performance in a variety of games. Abbas et al. (2019) argued that HCI has extensive applications in all fields. In the modern world of computers, the more a person interacts with a computer, the better he will be able to execute tasks.

Furthermore, HCI has a positive impact on innovation in the health care system. Sun and Jin (2019) studied human-computer interaction in the health care system by applying the HCI system to the teaching of medicine, physiology, and medical teaching in sport. Its functions and effects were also examined. It was studied that human-computer interaction is necessary for the advancement and innovation of sports psychology. By interacting with computers, humans can create various software programs employing artificial intelligence. HCI has facilitated the creation of sports education content and technological services. It was also beneficial to collect, maintain, and store a vast amount of information in a single space. Lyon et al. (2020) build an evaluation model by collecting and examining evaluation factors through a survey, and the results have been presented in the form of statistical data. (Gardner, 2021) researched human-computer interaction and its impacts on innovation and studied how HCI works in the field of sports on wearable smart systems. For this purpose, extensive research has been

conducted from almost 57 previous research papers, examined the collected data by GT (grounded theory), and identified that Human-computer interaction could enhance data protection.

It is highlighted that the computer and human interaction community had increased interest in investigating smart wearables devices in sports. To design technology that may be incorporated into the daily lives of athletes, it is necessary to completely comprehend their specific needs. In addition, Burr et al. (2020) assert that HCI is a multidisciplinary field of study that focuses on the user-centric design of sophisticated and contemporary computer systems. In addition, HCI was largely concerned with managing human interaction with these complicated and contemporary computer systems, ideally by extending the original design through post- installation review. A fundamental tenet of the HCI system was that technology must be developed and designed to benefit users (individuals) and the larger community through the employment of various user-centric procedures and approaches.

According to Triberti et al. (2021), Sophisticated Computer support systems or human-computer interaction systems used in the sector of Cognitive Info Com can enhance the standards of individuals' lives are suffering from cognitive impairments and other disabilities. (BCIs), Brain-computer interfaces were the example of HCI in the medical field, which enable the construction of an additional communication route between the human brain and computer system. In addition, (Gardner, 2021) presented their findings regarding the effects of HCI on sports psychology. It was investigated that HCI can improve sports psychology. In this research paper, the effectiveness of the HCI system in the innovation of sports psychology was also tested in a real-time environment and examined its significant influences on the innovation and advancement of the sport. Rapp (2020) studied that the most significant impact of Human-computer interaction was that it has made man's life easier in every field of life. It improves the quality of life through the innovation of various emerging technologies. Furthermore, through HCI, individuals do not require much more training from different sectors to learn about the sport.

Lopes (2016) said that the communication means utilized to control computer systems are the significant factors that greatly influence HCI. Apart from this, human-computer interaction has vast applications in economic growth. The advancement of HCI and technology has improved economic growth by increasing workers' productivity. The advancement of artificial intelligence and robots has made it possible for businesses to create entirely robotically-controlled corporations that do manual jobs freely, effectively, and rapidly. Katona (2021) noted that the study of HCI, i.e., human interaction with computers, is regarded as the sector where innovation, sports psychology, and social sciences

converge. Interaction between humans and computers has been an increasing trend in research and technology. It provides individuals with a superior interface for learning. At the same time, the sport has become the primary preoccupation of every nation in terms of economic development (Talha, Sohail, et al., 2020). Therefore, HCI has become essential for enhancing the learning capacity of athletes. Most athletes participate in multiple sports through HCI, which appears beneficial for studying sports psychology. Li and Xu (2022) investigated that HCI has significant impacts on improving humans' life, innovation in sports psychology, and many other fields of life. Therefore, it has become a need to develop the modern world. Apart from sport, it has provided a vast application to society. It has provided an easier and more comfortable life for individuals.

Hypothesis

H0= There is no relationship between human-computer interaction with innovation and sports psychology

H1= There is the positive effect of human-computer interaction on innovation and sports psychology

H2= There is a negative effect of human-computer interaction on innovation and sports psychology

H3= There is a significant effect of human-computer interaction on innovation and sports psychology

Research Methodology

This study examines the influence of human-computer interaction on both innovation and sports psychology. This research study is based on primary data analysis, and it employed particular questions linked to the variables to measure it. The human-computer interaction is the main independent variable the innovation. Also, sports psychology is a dependent variable.

Methods and Techniques

This research study represents in the form of quantitative and based on the primary data analysis. To measure the research study, smart PLS software and run different informative results including descriptive statistical analysis, indicators correlations, the R square values, F square values, the probability analysis, the co-linearity statistical analysis, also represent the smart PLS Algorithm model of dependent and independent indicators.

Variables:

Table-1

Sr. NO	Descriptions	Notations
1	Independent variables	IV
2	human-computer interaction	HCI
3	Computer science	CS
4	Human factors engineering	HFE
5	Cognitive science	CS
6	Innovation	Inn
7	Sport psychology	SP

Human-computer interaction

Human-computer interaction is the study of how people engage with technologies and how computers are developed to communicate with humans (HCI) effectively. HCI is increasingly being studied by many big organizations and academic organizations. Virtual reality is a great example of workplace human-computer interaction. A user interface is how humans interact with computers. Software and hardware are included, such as the computer monitor and peripherals like the mouse and keyboard. As a result, user pleasure is the emphasis of HCI research. The goal of Human-computer interaction is to create a consumer and practical system. To achieve this aim, development teams must be able to empathize with people and anticipate how they will utilize technology. Create tools and procedures that allow for best practices to create levels. The -computer interaction is the main independent variable that measures the impact on innovation and sports psychology.

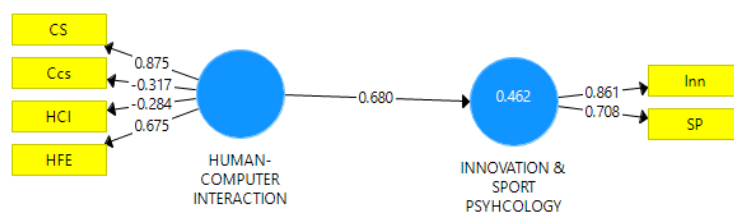
Computer Science

Computer science studies computers, computing, and their applications in theory and practice. Computer science uses mathematics, engineering, and logic concepts for various activities, including algorithm creation, software and hardware development, and artificial intelligence. It depends on the learner. A computer science student will find the task intriguing despite the difficulty of completing the task correctly. Computer science may be a difficult major due to its heavy workload and foundation in technical areas such as mathematics and programming. In addition to being a component of human-computer interaction, computer science is also regarded as an independent variable for evaluating their effect.

Human factors engineering

Human factors engineering is applying human factors knowledge to the analysis and design phase, equipment, systems, processes, professions, and environments to make them safe, enjoyable, and successful for people to use. Human-factors engineering has been used in many modern, advanced complexes, including data processing systems, computerized industrial sites, robotics, space vehicles, and simple equipment like highway signs, telephone sets, hand tools, and stoves. The objective is to develop equipment and systems that reduce the risk of human

Results and descriptions



The above model represents the smart PLS Algorithm

error, enhance system availability, cut lifetime costs, increase safety, and enhance overall system performance. The human factor engineering is the subpart of the independent variable its shows the relationship between them.

Cognitive science

Philosophy, psychology, artificial intelligence, neurology, languages, and culture are all components of cognitive science. Classic cognitive science subjects include anthropology, computer science, linguistics, psychology, philosophy, and psychology, despite the list of interrelated disciplines increasing (Talha, Azeem, et al., 2020). The cognitive science major provides students with a great degree of freedom, encouraging them to learn about the essential cognitive functioning of the mind and how to apply the social engagement of human behavior to diverse disciplines of study. In addition to being a subset of human computing interaction, cognitive science impacts innovation and general sports psychology performance.

Innovations

On the other hand, innovation can refer to anything new or changing a current product, concept, or region. The initial phone was a creation, the first cellular phone was either creation or a breakthrough, and the first smartphone was a breakthrough. You must do things differently or in ways that have never been done before to be creative. Accepting this premise, an innovator creates environments in which individuals are given the skills and tools they need to question things, push boundaries, and make progress. Innovation is the main dependent variable for analyzing the relationship with human computing interaction.

Sport Psychology

Athletes' optimal performance and well-being, psychological and behavioral elements of sports participation, and systemic difficulties connected with sports environments and organizations are all addressed by sports psychology. There is an increasing demand for sports psychologists to handle sports performance and mental health issues, which benefits sports psychology, athletes, and the general public. The sport psychology is main dependent variable its shows the impact of human computing interaction.

model related to the human-computer interaction with

innovation and sports psychology. The human-computer interaction is independent variable its included computer science, human factors engineering, and cognitive science; these are all subparts of independent variables. According to the result, computer science shows 0.875 rates with human-computer interaction, positively impacts positively impacting them positively. The human factor

engineering also shows a positive impact on the human-computer interaction. Its value is 0.675, respectively. The human-computer interaction shows that 0.680 68% positively relates to innovation and sports psychology. Innovation and sports psychology are both considered dependent variables. Its shows that 0.861 and 0.708 values present 86% and 70% positive values of each indicator.

Weighted average analysis

Table-2

	Human-Computer Interaction	Innovation Sport Psychology
Computer science	0.675	0.000
Cognitive science	-0.329	0.000
Human-computer interaction	0.083	0.000
Human factor engineering	0.488	0.000
Innovation	0.000	0.730
Sport Psychology	0.000	0.525

The above result describes the weighted average analysis of each variable. The result shows that human-computer interaction and innovation also sport psychology. The computer science shows that 0.675, which means that 67% weighted average rate with human-computer interaction shows a positive relationship between them. Cognitive science is the second independent variable. It presents the negative

effect of human-computer interaction. Its value is -0.329. The human factor engineering present that 0.488 value with the human-computer interaction. It's present that 48% positively relation with each other. Finally, sports psychology shows that 52% weighted average analysis with each other the innovation present that 0.730 weighted average value between them.

R-square

Table-3

	R Square	R Square Adjusted
Innovation & Sport Psychology	0.462	0.457

The above analysis represents that the R square values of the dependent variable, innovation, and sports psychology are the main dependent variable. The result shows that the R square's and R square's

values were adjusted. According to the result, its R square value is 0.462, and its adjusted R square value is 0.457, which means that 46% and 45% of research are fit for analysis.

F-Square

Table-4

Variables	Human-Computer Interaction	Innovation & Sport Psychology
Human-Computer Interaction	0.000	0.860
Innovation & Sport Psychology	0.000	0.000

The above table describes F square's value between human-computer interaction and innovation and sports psychology. According to the result, its F square value is

0.860, which means that 86% research is reliable for analysis.

Composite Reliability analysis

Table-5

	Cronbach's Alpha	Rho_A	Composite Reliability	Average Variance Extracted (AVE)
Human-Computer Interaction	0.391	0.332	0.257	0.350
Innovation & Sport Psychology	0.401	0.428	0.765	0.621

Cronbach Alpha values, Rho-A values, and composite reliability values are displayed in the above result for

the composite reliability analysis. The retrieved values of the average variance for each variable

contain both dependent and independent factors. For example, human-computer interaction is an independent variable. Its Cronbach's Alpha value is 0.391, its rho A value is 0.332 its composite reliability is 0.257. That average variance extracted value is 0.350, which means that the research model is fit for analysis at 25% rate levels. On the other hand, innovation and sports psychology both are considered dependent variable. It shows that the Cronbach Alpha value is 0.401, its rho A value is 0.428, its composite reliability value is 0.765, and the average variance extracted value is 0.621 result shows that 76% of the research is reliable for analysis.

Co-linearity Statistic Analysis

Table-6

Selection Criteria

Table-7

Variable	AIC (Akaike's I...)	AICu (Unbiased)	ALCc (Correct...	BIC (Bayesian...	HQ (Hannan...	HQc (Correct...
Innovation & Sport Psychology	-58.440	-56.419	42.813	-53.250	-56.340	-56.083

The above result describes that the model selection criterion for innovation and sports psychology yielded AIC, AICu, BIC, HQ, and HQc values for dependent variables. According to the results, the relevant values

Significant Analysis

Table-8

Matrix	Original Sample	Sample Mean(M)	Standard Deviation(STDEV)	T Statistic (O/...	P-Value
CS<- Human-Computer Interaction	0.875	0.857	0.052	16.979	0.000
Ccs<- Human-Computer Interaction	-0.317	-0.297	0.248	1.279	0.202
HCI<- Human-Computer Interaction	-0.284	-0.244	0.271	1.045	0.296
HFE<- Human-Computer Interaction	0.675	0.648	0.140	4.832	0.000
Inn<- Human-Computer Interaction	0.861	0.866	0.057	15.028	0.000
SP<- Human-Computer Interaction	0.708	0.684	0.135	5.231	0.000

The above result describes that significant analysis of dependent and independent variables result shows the original sample value, the sample means value, standard deviation values, the rate of T statistic, and the probability values of each variable. The first matrix is computer science <- human-computer interaction. Its original sample value is 0.875, its mean value is 0.85 shows that 85% average value of the mean, its standard deviation rate is 0.052, the T statistic value is 16.979, and the probability value is 0.000, which means that 100% significantly relation in between computer science and human-computer interaction. The second matrix is cognitive science <-. Human-computer interaction shows that 1.279 its significant level is

	View
Computer science	1.190
Cognitive science	2.169
Human-computer interaction	2.133
Human factor engineering	1.177
Innovation	1.067
Sport psychology	1.067

The above result describes that the statistical analysis of colinearity reveals the VIF values of each variable. The result indicates that its values are 1,190, 2,169, 2,133, 1,177, and 1.067. These values represent the positive indication values. Model

for each indicator are -58.440, -56.401, 42.813, -53.250, -56.340, and -56.083, indicating negative values.

0.202, which means a 20% significant relation between them. The human-computer interaction and human factor engineering present that deviation value is 4.832. Its probability value is 0.000, which shows a positive and significant relation between human-computer interaction and human factor engineering. Finally, innovation is the dependent variable. It shows that concerning human-computer interaction, its original sample value is 0.861. Its T statistic value is 15.028, and the significant rate is 0.000, which means a 100% significance level and positive relation between dependent and independent variables. Sports psychology is the main dependent variable. Its original sample value is 0.708, its standard deviation value is

0.135, its T statistic value is 5.231, and its significant level is 0.000, which shows a positive and significant

relation between sports psychology and human-computer interaction.

Indicator Correlation

Table-9

Indicators	No.	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
Human-computer interaction	1	0	2.657	2.000	1.000	7.000	1.596	-0.114	0.655
Computer science	2	0	3.525	4.000	1.000	5.000	1.095	-0.004	-0.698
Human factor engineering	3	0	3.596	4.000	1.000	5.000	1.154	-0.413	-0.598
Cognitive science	4	0	2.929	3.000	1.000	7.000	1.513	0.050	0.460
Innovation	5	0	3.111	4.000	1.000	5.000	1.332	-1.202	-0.363
Sport Psychology	6	0	3.434	4.000	1.000	5.000	1.216	-0.857	-0.341

The above result describes that indicator correlation result shows that missing values, the mean values of each variable, the minimum and maximum values, standard deviation rate, and excess kurtosis values also present the skewness values of each variable. The overall value missing is zero. Accordingly, the minimum value is 1.000 overall. Maximum values are 7,000 and 5,000. Interaction between humans and computers is the primary independent variable. Its mean value is 2,657, indicating a positive average value for the mean; its standard deviation rate is 1,596, and its skewness value is 0.655. The major dependent variable is sports psychology. The mean value is 3.434, the standard deviation is 1.216, and the skewness rate is -0.341. The human engineering factor is an independent variable. Its average value is 3.596, indicating that the mean has a positive average value. The result reveals 1,154 rates of human factor

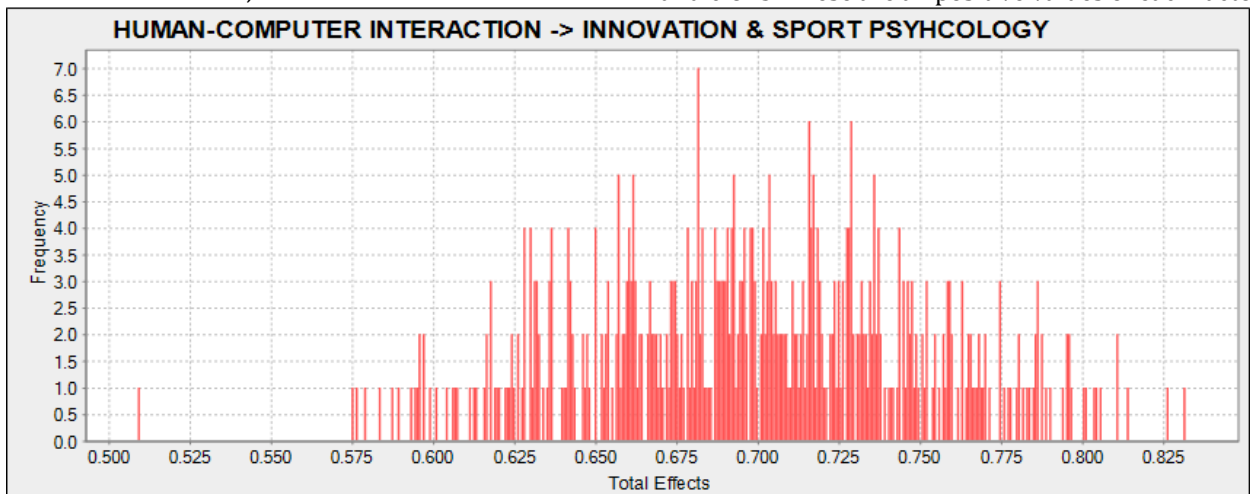
engineering standard deviation.

Model Fitness Analysis

Table-10

	Saturated Model	Estimated model
SRMR	0.214	0.214
D_ULS	0.958	0.958
D_G	0.675	0.675
Chi-Sqaure	236.431	236.431
NFI	0.080	0.080

The above result represents the model fitness analysis result shows the saturated model and value of the estimated model. The result presents the SRMR rate, D-ULS rate, D-G rates, Chi-square values, and NFI rates of each model. The saturated model shows that 0.214, 0.958, and 0.675 are the present positive value of the saturated model. The chi-square value of the saturated model is 236.431its estimated value is 236.431, respectively, which shows that the model is fit for analysis. The estimated model values are 0.214, 0.958, and 0.675. These are all positive values of each factor.



The above graph represents the total effect between human-computer interaction, innovation, and sports psychology. The vertical side shows the frequency level, which starts from 0.0 and ends at 7.0. Levels on the horizontal side present the whole effect range starting from 0.500 and ending at 0.825 levels. The red bar above presents the fluctuation rates between human-computer interaction, innovation, and sports psychology.

Conclusion

In conclusion, we discovered that technology has drastically altered our lives and accelerated the passage of time. Humans have developed and refined technologies to better our lives. Therefore, HCI human-computer interaction research has become an increasingly vital area of study (Chen et al., 2021). It has transformed the lives of humanity. This study examined the effects of human-computer interaction on sports psychology and creativity.

For this reason, a substantial quantity of research has been undertaken based on previous literature, and sample data has been gathered through a questionnaire survey. Human-computer interaction's positive effects on human life, innovation, and sports psychology are investigated. It is applicable in every aspect of life. It has made a living more convenient and comfortable (Lopes, 2016). It can enhance the quality of life for individuals (Yang et al., 2022). Human-Computer Interaction (HCI) is the study and understanding of computers, humans, and their human interactions with computers. It is the interchange of knowledge and information between a computer system and humans regarding various behaviors, activities, and symbols. Now, technology can help humans live better lives, but it also has several detrimental effects (Brinkley et al., 2019).

Creativity, curiosity, and intelligence have resulted in technological growth. However, humans must be

intelligent enough to exploit technology effectively. Ultimately, the HCI has transformed our conceptions of knowledge and data (Jeunet et al., 2020). This study aimed to comprehend the effects of HCI on innovation and sport and to employ HCI to enhance invention and team performance. Additionally, it has been utilized better to comprehend sports psychology (Siricharoen, 2019). A strong relationship between humans and computers is also emphasized. The more humans connect with computers and technology, the more efficiently they will do activities. This study also examines the HCI's pros and downsides. Aside from this, various smart wearable technologies based on artificial intelligence AI are used in the sports industry today to comprehend human emotions (Khanam et al., 2021). With the development of new technology, HCI is now an integral aspect of every person's life. The interaction between humans and computers enhances the quality of life.

Furthermore, the HCI is solely responsible for the invention in sports psychology and many other domains (Ball & Richardson). This research describes the impact of human-computer interaction on innovation and sports psychology. For this aim, smart PLS software was used to generate different results, including indicators for correlation, F square, R square, and colinearity. The research revealed that human computing contact had favorable and significant effects on innovation and athletic psychology.

We investigated how human-computer interaction can impact the lives of humans when computers and people interact. It can detect, process, and react to human emotion to construct smart, intelligent information systems (Alkathairi, 2022). This study article demonstrates that HCI is crucial for economic expansion. Moreover, improvements in the quality of human contact with computers play a crucial part in communicating ordered and programmed emotional responses. HCI is needed in order to build modern world (Seinfeld et al., 2021).

References

- Abbas, R., Marsh, S., & Milanovic, K. (2019). Ethics and System Design in a New Era of Human-Computer Interaction [Guest Editorial]. *IEEE Technology and Society Magazine*, 38(4), 32-33. <https://doi.org/10.1109/MTS.2019.2948448>
- Alkathairi, M. S. (2022). Artificial intelligence assisted improved human-computer interactions for computer systems. *Computers and Electrical Engineering*, 101, 107950. <https://doi.org/10.1016/j.compeleceng.2022.107950>
- Balcombe, L., & De Leo, D. (2022). Human-Computer Interaction in Digital Mental Health. *Informatics*, 9(1), 14. <https://doi.org/10.3390/informatics9010014>
- Bateman, P. J., Gray, P. H., & Butler, B. S. (2011). Research note—the impact of community commitment on participation in online communities. *Information systems research*, 22(4), 841-854. <https://doi.org/10.1287/isre.1090.0265>
- Brinkley, J., Posadas, B., Sherman, I., Daily, S. B., & Gilbert, J. E. (2019). An open road evaluation of a self-driving Vehicle human-machine interface designed for visually impaired users. *International Journal of Human-Computer Interaction*, 35(11), 1018-1032. <https://doi.org/10.1080/10447318.2018.1561787>
- Burr, C., Taddeo, M., & Floridi, L. (2020). The ethics of digital well-being: A thematic review. *Science and engineering ethics*, 26(4), 2313-2343. <https://doi.org/10.1007/s11948-020-00175-8>
- Chen, M. A., Spanton, K., van Schaik, P., Spears, I., & Eaves, D. (2021). The Effects of Biofeedback on Performance and

- Technique of the Boxing Jab. *Perceptual and motor skills*, 128(4), 1607-1622. <https://doi.org/10.1177/00315125211013251>
- Gill, D. L., Reifsteck, E. J., & Madrigal, L. (2021). From sport psychology to sport and exercise psychology: A 40-year update. *Kinesiology Review*, 10(3), 301-307. <https://doi.org/10.1123/kr.2021-0020>
- Gardner, M. (2021). California Tool Works: Assessing the Impact of Life Science Incubators and Accelerators. *Journal of Commercial Biotechnology*. Doi: 10.5912/jcb977
- John M. York, V. P. (2022). Market Selection for MyoTecSci: How to Decide “Where to Play” from Multiple Options. *Journal of Commercial Biotechnology* Doi: 10.5912/jcb1010.
- Jeunet, C., Hauw, D., & Millán, J. d. R. (2020). Sport psychology: Technologies ahead. *Frontiers in Sports and Active Living*, 2, 10. <https://doi.org/10.3389/fspor.2020.00010>
- Katona, J. (2021). A review of human-computer interaction and virtual reality research fields in cognitive InfoCommunications. *Applied Sciences*, 11(6), 2646. <https://doi.org/10.3390/app11062646>
- Khanam, M. S., Padebettu, N., & Krishna, V. (2021). Role Of Human-Computer Interaction (HCI). *Iconic Research and Engineering Journals*, 5(3), 84-90. <https://www.irejournals.com/formatedpaper/1702921.pdf>
- Li, X., & Xu, Y. (2022). Role of Human-Computer Interaction Healthcare System in the Teaching of Physiology and Medicine. *Computational Intelligence and Neuroscience*, 2022. <https://doi.org/10.1155/2022/5849736>
- Liu, J., Wang, L., & Zhou, H. (2021). The Application of Human-Computer Interaction Technology Fused With Artificial Intelligence in Sports Moving Target Detection Education for College Athlete. *Frontiers in Psychology*, 2848. <https://doi.org/10.3389/fpsyg.2021.677590>
- Lopes, A. G. (2016). Using research methods in human computer interaction to design technology for resilience. *JISTEM-Journal of Information Systems and Technology Management*, 13(3), 363-388. <http://dx.doi.org/10.4301/S1807-17752016000300001>
- Lyon, A. R., Brewer, S. K., & Areán, P. A. (2020). Leveraging human-centered design to implement modern psychological science: Return on an early investment. *American Psychologist*, 75(8), 1067. <https://doi.org/10.1037/amp0000652>
- Nurja, A., Peev, P., & Gadev, M. (2022). Synergetic approaches as new modern innovations in physical culture and sports. *European Journal of Health & Science in Sports Volume*, 9(1), 11-20. <http://dx.doi.org/10.33598/V9I2202211>
- Rapp, A. (2020). Design fictions for learning: A method for supporting students in reflecting on technology in Human-Computer Interaction courses. *Computers & Education*, 145, 103725. <https://doi.org/10.1016/j.compedu.2019.103725>
- Ren, F., & Bao, Y. (2020). A review on human-computer interaction and intelligent robots. *International Journal of Information Technology & Decision Making*, 19(01), 5-47. <https://doi.org/10.1142/S0219622019300052>
- Seinfeld, S., Feuchtnner, T., Maselli, A., & Müller, J. (2021). User representations in human-computer interaction. *Human-Computer Interaction*, 36(5-6), 400-438. <https://doi.org/10.1080/07370024.2020.1724790>
- Siricharoen, W. V. (2019). Understanding Social Interaction with Human Computer Interaction (HCI) Adaptation. *EAI Endorsed Transactions on Context-aware Systems and Applications*, 6(18), 1-9. <https://doi.org/10.4108/eai.13-7-2018.160762>
- Sun, X., & Jin, W. (2019). Health Informatics Study of Smart Human-Computer Interaction Devices for Elderly Patients. *Journal of Medical Imaging and Health Informatics*, 9(8), 1607-1613. <https://doi.org/10.1166/jmihi.2019.2780>
- Talha, M., Azeem, S., Sohail, M., Javed, A., & Tariq, R. (2020). Mediating effects of reflexivity of top management team between team processes and decision performance. *Azerbaijan Journal of Educational Studies*, 1(1), 105-119. <https://doi.org/10.29228/edu.91>
- Talha, M., Sohail, M., & Hajji, H. (2020). Analysis of research on amazon AWS cloud computing seller data security. *International Journal of Research in Engineering Innovation*, 4(3), 131-136. <https://doi.org/10.36037/IJREI.2020.4302>
- Triberti, S., Di Natale, A. F., & Gaggioli, A. (2021). Flowing technologies: The role of flow and related constructs in human-computer interaction. In *Advances in Flow Research* (pp. 393-416). Springer. https://doi.org/10.1007/978-3-030-53468-4_15
- Yang, P., Shi, Y., Li, S., Tao, X., Liu, Z., Wang, X., . . . Chen, X. (2022). Monitoring the degree of comfort of shoes in-motion using triboelectric pressure sensors with an ultrawide detection range. *ACS nano*, 16(3), 4654-4665. <https://doi.org/10.1021/acsnano.1c11321>
- Zhou, D., Zhu, D., Zhang, F., Li, G., & Zong, K. (2021). Modern Physical Education and Its Influence on Students' Entrepreneurial Psychology in Sports Universities. 12(1), 1-9. <https://doi.org/10.3389/fpsyg.2021.751176>