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RESEARCH ARTICLE

Research Progress, Hotspots, and Trend Analysis of Emotional Design Based On Bibliometrics

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ABSTRACT

Objective systematically understand the global characteristics of the research on affective design in the international context, to grasp the current research hotspots and theoretical foundations of affective design, and to explore the new trends of future development based on the current research hotspots. Methods The literature on emotional design collected by Web of Science was used as the data source, and VOSviewer and CiteSpace were used to draw the scientific knowledge map from the distribution of year and output of the literature, countries, research institutions, authors, citation status of references, and keyword clustering, etc., and visual analysis was carried out to sort out the research lineage. Conclusion The results indicate that the overall number of literature within the search scope is on the rise, with countries such as China and the United States at the forefront of research. Research hotspots mainly focus on learning emotions, psychological cognition, product and user experience, and design evaluation. The research status is relatively mature, forming a theoretical system mainly based on three-level theory and sensory engineering. Multimedia learning, product is new trends in future development. The lack of close collaboration between research institutions and authors, as well as the limited number of high-yield authors, are the main limitations of current research.

INTRODUCTION

Emotional design is a product design concept and method that emerged in the late 1980s, and has not yet reached a consensus definition in the academic community. In English, emotional design is generally expressed as "Emotional Design" and "Affective Design". American scholars Norman and Delaporte, in their book User-Centered System Design: New Perspectives on Human-Computer Interaction, published in 1986, proposed for the first time that "user-centred design" can be regarded as emotional design. "It can be regarded as the original concept of emotional design. Emotional design mainly includes the acquisition, analysis and modelling of the user's emotional factors, as well as the transformation of emotional factors in specific designs (Luo, 2007; Li YZ, 2003). In recent years, the application of affective design theories and methods in art design has become more and more common, and a large number of literature results have been accumulated in this field. After years of accumulation, the amount of research literature in this field is numerous, and the knowledge structure is diversified and complex, so it is difficult to objectively analyse the research hotspots and development dynamics in this field by only relying on the analysis method of reviewing and summarising the traditional literature at a stage, and it is even more difficult to accurately grasp how affective design theories and methods affect design activities in a specific way. In order to more

comprehensively explore the research status, research hotspots and development trends of affective design, the study uses the Web of Science (WOS) database as the data source, and visualises the knowledge structure of the existing literature with the help of scientific bibliometrics, so as to provide scholars in this field with reference and an overall overview of the research.

RESEARCH DESIGN

Data sources

As high quality scientific literature is subject to rigorous peer review and scrutiny by the publication journals, its findings are more representative of the discipline (CHALCRAFT A, 2004). The following study chose to search the Web of Science core database with the search strategy set to TS= ("Emotional Design") or TS= ("Affective Design"). The five major citation indexes commonly used in WOS database, namely SSCI, SCI-Expanded, A&HCI, CPCI-S and CPCI-SSH, were selected as the search sources. In order to collect all relevant articles, the time span of the search was set to the full year (i.e., from 1900 to December 2023). In order to avoid the loss of interdisciplinary literature, the sources were not streamlined. The retrieved articles were exported as txt files in the format of "full record with cited references", and the interfering articles such as deviating from the research topic, missing field information (e.g., time, keywords, authors, and other key information), and duplicated data were excluded. A total of 741 articles were obtained for further quantitative analysis.

Research methodology

Through scientific bibliometric methods and knowledge structure visualisation, software such as VOSviewer and CiteSpace are combined to obtain more comprehensive data. Bibliometrics refers to the discovery of potential patterns and information in a large amount of literature data through quantitative analysis of various types of literature and was first proposed by Pritchard in 1969.VOSviewer was developed by Van Eck and Waltman from the Centre for Scientific and Technological Research at Leiden University, the Netherlands, in 2009, and it has a powerful user graphical interface and mapping visualisation functions (VANECK N J,2010).CiteSpace is a citation visualisation and analysis software developed by Chao-Mei Chen's team (2006) at Drexel University, USA, which has been widely used in bibliometric analysis in recent years.

EMOTIONAL DESIGN BIBLIOMETRIC RESULTS AND ANALYSIS

Essential Features of Emotional Design Research

The pattern of change in the output of academic literature over time is an important method to measure the development trend of research topics, which can effectively assess the research dynamics of the discipline. The data obtained from the search is cleaned and de-weighted for field extraction, and the distribution of the annual number of articles published in the emotional design literature (Fig. 1). As seen from the issuance of WOS, the number of annual articles published ranged from 1 in 2000 to 74 in 2022, with a general upward trend in literature output, and a decrease in the number of publications in 2023. As can be seen from the literature output, the research topic of affective design is constantly evolving and has been the focus of scholarly attention in recent years.

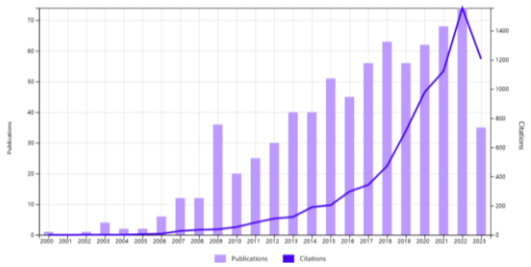

Figure 1: Distribution of annual publication volume of emotional design literature

Emotional design is a complex cross-cutting theme that involves knowledge from multiple subject areas. According to the disciplinary statistical analysis of the WOS system, 116 disciplines are involved in 741 documents, and the top 10 disciplines are Education Educational Research (49 articles, 10.166%), Psychology Multidisciplinary (45, 9.336%), Psychiatry (44 articles, 9.129%), Engineering Multidisciplinary (40 articles, 8.299%), Ergonomics (35 articles, 7.261%), Computer Science Artificial Intelligence(34 articles, 7.054%), Engineering Industrial(28 articles, 5.809%), Neuro sciences (28 articles, 5.809%), Engineering Electrical Electronic(24 articles, 4.979%), Computer Science Information Systems, and Engineering Manufacturing (21 articles, 4.357%) (Fig.2). These disciplinary topics are important research areas for affective design, providing theoretical foundations and tools and methods for affective design research. At the same time, the proposal of affective design also provides a good opportunity for the development of these disciplines.

Figure 2: Involving disciplinary fields

Distribution of literature by country and research organisation

The number of publications and the number of citations by country/region in the dataset depicts the high-producing countries in the research field and their impact. In terms of country/region outputs, a total of 61 countries/regions around the world have contributed in this research area. Among them, the top 10 countries (Table1) account for more than 45.748% of the total number of publications. The output of papers within the search range are all higher than 24 papers, which is an important source of output for emotional design research worldwide. China is the country with the highest productivity in emotional design research, with a total of 284 articles (including Taiwan) (accounting for 38.327% of the total number of publications), ranking first in the total number of publications, followed by USA (85 articles, accounting for 11.471% of the total number of publications), GERMANY (53 articles), JAPAN (39 articles), ENGLAND (32 articles), SOUTH KOREA (30 articles), MALAYSIA (27 articles), SINGAPORE (25 articles), and AUSTRALIA (24 articles) SPAIN (24 articles).In terms of the number of articles, China, the United States and Germany all have more than 50 articles, while the other countries have much fewer in comparison. In addition, the average citation of China and the United States is also at the top of the list. In the research cooperation network China maintains cooperative relations with many countries such as the United States, the United Kingdom, Italy, Japan, South Korea and Singapore, but they are not close enough and are mostly distributed in a piecemeal manner.

Table 1: Top 10 countries with the highest number of publications

Countries/Regions	Record Count	% of 741
PEOPLES R CHINA (include Taiwan)	284	38.327

USA	85	11.471
GERMANY	53	7.152
JAPAN	39	5.263
ENGLAND	32	4.318
SOUTH KOREA	30	4.049
MALAYSIA	27	3.644
SINGAPORE	25	3.374
AUSTRALIA	24	3.239
SPAIN	24	3.239
Total	339	45.748

As of December 2023, 679 research institutions worldwide have conducted research on emotional design. Run VOSviewer, select Organizations, set the node threshold to 3, and get the number of nodes as 95. The node size of the organisations in the figure indicates the output of the articles, and the line between the organisations represents the intensity of cooperation, the closer the cooperation, the wider the line between the organisations (LI H, 2016). From the distribution of the strength of cooperation relationship (number of times of cooperation) within each sub-network, the international cooperation of affective design research is not close, showing strong geographical characteristics, mainly focusing on the cooperation between institutions in their own countries and regions. Institutional co-operation is "regionally concentrated, overall dispersed", with "Nanyang Technological University", "Hong Kong Polytechnic University" and "Delft University of Technology" as the main high-impact research institutes. Nanyang Technological University", "Hong Kong Polytechnic University" and "Delft University of Technology" form three large subgroups of high-impact research institutions. Within the search scope, Nanyang Technological University ranked 1st with 22 articles, followed by Hong Kong Polytechnic University (21 articles), Charles university (13 articles), Cent China normal university (12 articles) and University Calif santa barbara (12 articles). (12 articles) and University Calif santa barbara (12 articles) (Fig. 3 and Table2).

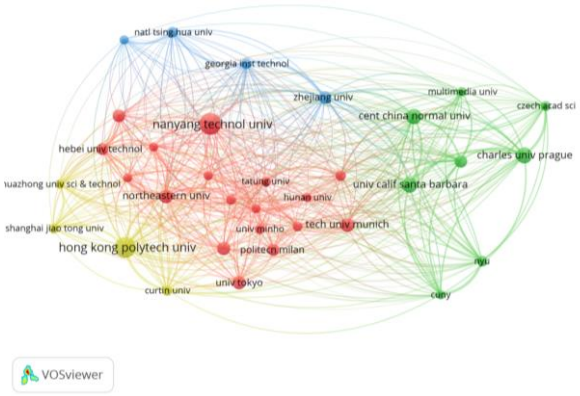

Figure 3: Cooperative institutions co-occurrence network

Table 2: Institutions-Top 10 Number of Documents Issued

Order	Organization	Documents	Citations	Total link strength
1	Nanyang technol univ	22	576	4
2	Hong kong polytech univ	21	455	6
3	Charles univ prague	13	177	6
4	Cent china normal univ	12	68	4
5	Univ calif santa barbara	12	586	2
6	Northeastern univ	11	260	1
7	Tech univ munich	11	54	0
8	Tech univ denmark	10	54	2
9	Univ tokyo	10	35	2
10	East china univ sci & technol	9	45	1

Most influential journals and author co-operation networks

The articles in the search were from 450 journals. The top 10 most productive journals in terms of publications from 1996-2020 are listed (Table 3). The top journal in terms of publications is Computers & Education, with 13 articles, 626 citations, and a Journal Impact Factor of five years is 12.6; the second is Frontiers in Psychology, with 13 articles and 90 citations,and the Journal Impact Factor of five years is 4.3; The 3rd ranked is International Journal of Industrial Ergonomics with 13 articles, 441 citations, and Journal Impact Factor of five years is 3. Among them, Computers & Education is ranked the highest in terms of both output(13)and citations (48.153), reflecting its significant influence in the field of affective design research and its core position in this field of journals.

Table 3: The top 10 journals in terms of publication volume

Order	Source	Documents	Citations
1	Computers & Education	13	626
2	Frontiers in Psychology	13	90

3	International Journal of Industrial Ergonomics	13	441
4	Advances in Affective and Pleasurable Design	12	11
5	Journal of Engineering Design	12	234
6	6th International Conference on Applied Human Factors and Ergonomics	11	41
7	Journal of Computer Assisted Learning	11	374
8	Computers in Human Behaviour	9	398
9	Design for Harmonies, vol 7: Human Behaviour in Design	8	12
10	Learning and Instruction	8	609

Authors are the smallest unit of literature output and direct contributors to affective design research. By examining author co-citations, it is possible to identify the more active scholars in this field worldwide. Through the preliminary analysis of author names and co-citation analysis after disambiguation of authors, the largest sub-network of author outputs and collaborations in affective design research was extracted from 1,801 authors and 28 pairs of collaborations. The data statistics revealed that there are not many high-producing authors, among which brom, cyril has the most publications and ranked 1st with 13 publications within the search. followed by mayer, richard e. (11 publications), beege, maik (9 publications), kwong, c. k. (9 publications). The most prolific authors with the highest total citations were plass, jan l. with 7 publications within the search and 766 total citations, followed by homer, bruce d. (5 publications with 621 total citations), mayer, richard e. (11 publications with 359 total citations),. In addition, collaborative research among scholars is not close and is mostly based on sporadic inter-institutional collaboration, which is the current status of affective design research.

Analysis of Hot Spots and Frontier Trends in Emotional Design Research

The keywords of the literature are highly refined by the authors of their research, and the high-frequency co-occurring keywords reflect the research hotspots of affective design in the long term. The 741 documents within the search scope contain 2511 keywords, and Vosviewer was run to set the keyword co-occurrence frequency to 7, and 99 keywords were filtered and merged with synonyms to form the keyword co-occurrence clusters (Fig. 4). The keywords with the same colour in the figure are the same clusters, and a total of 5 major clusters (Clusters) were formed. From the analysis results, the hot research topics of emotional design can be divided into five major categories.

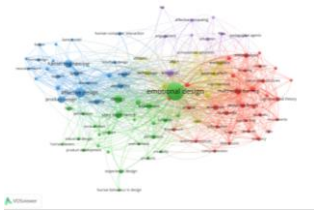

Figure 4: Keywords co-occurrence clustering network

Cluster #1 (red) contains a total of 32 cluster members, mainly containing multimedia learning, attention, cognitive load, metaanalysis, details, features, performance, decorative pictures, Achievement, memory, information, text, arousal, framework, learning, students, children, eye-tracking, personalisation, knowledge, pictures, anthropomorphism, illustrations, movements, science, working-memory, comprehension, games, instructional-design. This clustering of keywords is mainly related to education, learning, and cognition. It can be seen that the research object of emotional design gradually shifts from computer visual features to the users themselves.

Cluster #2 (green) contains a total of 25 cluster members, mainly containing user experience, Emotions, Form, Perception, Behaviour, positive emotions, responses, product development, perception, sustainability, user-centered design, consumption, industrial design, preferences, creativity, human behaviour in design, human factors, and complexity. The clustering reflects that affective design research not only focuses on visual objects such as form and colour, but also on user behaviour and user experience. Design concepts and objects are also expanding, from tangible physical products to intangible virtual products and interactive processes, and the basic principle of "user-centredness" is emphasised and practised.

Cluster 3#(blue) contains a total of 22 cluster members, mainly containing kansei engineering, product design, consumer-oriented technology, interface design, product form, aesthetics, usability, satisfaction, customer satisfaction.This cluster mainly involves perceptual engineering, product design, human-computer interaction, design evaluation and so on. Taken together, the degree of concern mainly around product design and user experience is an important guidance for the development of targeted product design strategies and the enhancement of user satisfaction.

Cluster 4#(yellow) contains a total of 11 cluster members, mainly containing motivation, positive affect, colour, negative affect, cognitive-load, achievement emotions, and attitudes.This cluster covers a wide range of emotional, mental and cognitive domains. It can help to understand the differences between different groups in these key aspects, and may have important applications in the fields of psychology, marketing, and even personal development.

Cluster 5# (purple) contains 9 cluster members, which mainly contain affective computing, emotion, education, engagement, gamification, e-learning, and pedagogical agents.This cluster involves the key features of the educational technology field. This cluster covers key features in the field of educational technology, and the study of this cluster can help to promote innovation in the field of education and provide learners with more diversified, personalised and engaging learning experiences.

In order to further study the cutting-edge themes and development trends of affective design research, the average occurrence times of keywords were statistically analysed and superimposed on the original cluster diagram(Figure 5). From the research hotspots summarised in the five clusters in Figure 5, it can be found that the overall time of the keywords in Cluster #1 -multimedia learning in which the overall time of the keywords is the closest to the present, is a cutting-edge topic of the current research on affective design; secondly, cluster #4 - is also a research direction that is the focus of the current research on affective design; and cluster #3, with an overall average time of occurrence before 2015, is a hotspot of early research in the discipline. Keywords across the clustering network with an average occurrence time later than 2019 onwards are mainly MULTIMEDIA LEARNING, ATTENTION, COGNITIVE LOAD, META ANALYSIS, FEATURES, MEMORY, INFORMATION, and ACHIEVEMENT.

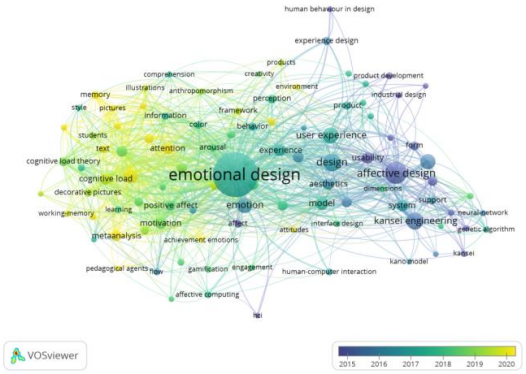

Figure 5: Keywords co-occurrence clustering superposition network

In order to further explore and support the cutting-edge development trend of affective design research, CiteSpace's Burst Term mapping is comprehensively applied in the study (Fig. 6). Fig. 6 lists the Top15 keywords in terms of burst intensity, where the dark part (red) indicates the years in which the keywords are cited with relatively prominent frequency, which reflects the trend of research change. Sorting the Top15 keywords by time, it can be seen that the research hotspots are divided into 3 obvious intervals; from the evolution of keywords in the 3 intervals, the research objects show the trend of change from products to people, which also matches the results obtained from the time-keyword clustering. The keywords that appeared in the last 5 years among the high-intensity emergent words are decorative picture, multimedia learning, anthropomorphism, feature, positive affect, and product. comprehensively analysing the time-keyword clustering graph and the Burst Term, it can be seen that emotionality is the most important keyword in the study, and it is the most important keyword in the study. Burst Term can be seen that the future research content of affective design focuses on multimedia learning, feature and product, etc., and the research trend shows that the research content is refined, and more attention is paid to the user's personalised, differentiated emotion identification and expression to create a better user experience.

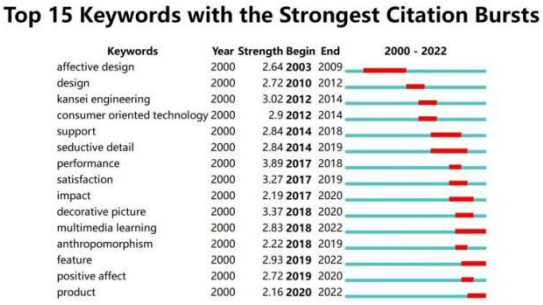

Figure 6: Keywords Burst Term

Theoretical Foundations of Emotional Design Research

According to statistics, the 741 documents within the search scope have cited a total of 19,212 valid references from 4058 scholars. As some references are cited in pairs to form a co-citation relationship, the whole set of references forms a co-citation network. The co-citation network shows the evolution of affective design research at the basic knowledge level. The co-citation network was constructed by extracting the references with citation frequency not less than 5 from 1990 to 2020, and a co-citation cluster consisting of 495 references and 24,922 co-citation relationships was generated (Fig. 7).

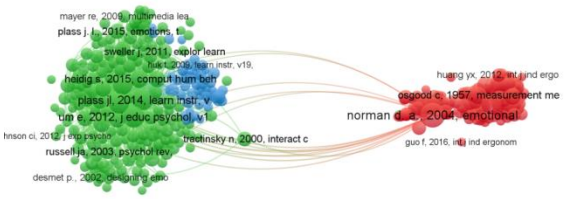

Figure 7: Reference co-citation clustering network

The clustering network shows the authors and publication time of the literature with a citation frequency of not less than 5, and the many nodes form 3 main clusters: #1 (red) - Emotional Design represented by Professor Norman D A's three-level theory; #2 (green) #3 (blue) all with multimedia learning as the topic of research. The classic literature of each cluster with Top5 citations is shown in Table 4, reflecting the classic literature of each cluster with Top5 citations, and the literature contained in these three clusters constitutes the most important knowledge base of the research on Emotional Design, forming the mainstream theoretical system and linking up most of the research contents.

Table 4: Classical literature in the top 5 total citations for each cluster

Cluster	Literature Information	Citations	Total link strength
#1	Norman d. a., 2004, emotional design: why we love (or hate) everyday things (book)	162	1266
#1	Nagamachi m, 1995, Kansei Engineering: A new ergonomic consumer-oriented technology for product development	80	916
#1	Jordan p.w., 2000, Designing pleasurable products (book)	48	334
#1	Osgood c, 1957, measurement meaning (book)	46	433
#1	Nagamachi m, 2002, Kansei engineering as a powerful consumer-oriented technology for product development	44	516
#2	Um e, 2012, Emotional Design in Multimedia Learning Emotional Design in Multimedia Learning	105	2138
#2	Jan L. Plass, 2014, Emotional design in multimedia learning: effects of shape and colour on affect and learning	92	1961
#2	Park b, 2015. Emotional design and positive emotions in multimedia learning: an eyetracking study on the use of anthropomorphisms	48	1629
#2	R. Moreno r, 2007, Interactive Multimodal Learning Environments Special Issue on Interactive Learning Environments:Contemporary Issues and Trends	70	1178
#2	Heidig s, 2015. Emotional design in multimedia learning: differentiation on relevant design features and their effects on emotions and learning	50	1113
#3	Mayer re, 2014. Benefits of emotional design in multimedia instruction	77	1652

#3	Brom c, 2018, How effective is emotional design? A meta-analysis on facial anthropomorphisms and pleasant colours during multimedia learning	34	842
#3	Sweller j, 2011. Cognitive Load Theory	32	828
#3	Wong rm, 2021,Meta-Analysis of Emotional Designs in Multimedia Learning: a Replication and Extension Study	21	537
#3	Horovitz t, 2021. Learning with human and virtual instructors who display happy or bored emotions in video lectures	11	255

In cluster #1, a relatively large co-citation network is formed centred on the book Emotional Design published by American cognitive psychologist NORMAN D A in 2004, which is regarded as a classic work on emotional design research and has been cited 9779 times (as of November 2023) in Google Scholar. In Emotional Design, Professor Norman explains the importance of emotion in design based on three different dimensions: instinctive, behavioural and reflective, and emphasises that design should focus on the user's experience in these three dimensions. In addition, the rest of this clustering that has attracted a lot of attention is JORDAN P W's 2000 book Designing Pleasurable Products, which outlines a new approach to the study of human factors diversity based on the realisation that the quality of the relationship between a person and a product is not only dependent on the product's usability, but is also affected by the emotional factors of pleasure or displeasure that the product brings.In 1995, scholar Nagamachi introduced in his article "Kansei Engineering - A New Ergonomic Consumer-Oriented Technology for Product Development" the " Kansei Engineering". This article explored how human emotional perception and engineering can be combined to develop products that better meet the emotional needs of consumers. Nagamachi continued his discussion of Kansei Engineering in his 2002 article, emphasising the role of Kansei Engineering in product development and how it can be used to create products that better meet the emotional needs of consumers and improve the quality of products. Osgood, Suci and Tannenbaum (1957) presented their findings in "The Measurement of Meaning", discussing how to quantify and measure emotion and meaning in language. They proposed a method called the Semantic Differential Scale to assess the relationship between words, concepts, or other symbols and emotional dimensions. This method allows researchers to quantify the meaning of words and their associations with emotion, and thus measure and analyse the emotional significance of language. This research is an important contribution to understanding the quantitative aspects of emotion and meaning in language.

In clustering #2, the articles "Emotional Design in Multimedia Learning" and "Emotional design in multimedia learning: effects of shape and colour on affect and learning" were used as the The core of the co-citation network was formed with the theme of multimedia learning. Emotional Design in Multimedia Learning, published in the Journal of Educational Psychology in 2012 by Um, Plass, Hayward and Homer, focuses on the theme of "emotional design in multimedia learning". It focuses on the topic of "Emotional design in multimedia learning" and how emotional design principles can influence learners' learning outcomes in multimedia learning environments. Emotional design in multimedia learning: Effects of shape and colour on affect and learning examines design factors that may trigger positive emotions in learners and explores the impact of these positive emotions on learning. The findings show that well-designed materials can trigger positive emotions and promote comprehension, and that round facial shapes alone or in combination with warm colours can trigger positive emotions. Scholar R. Moreno r (2007) in his article "Interactive Multimodal Learning Environments Special Issue on Interactive Learning Environments:Contemporary Issues and Trends", he proposed a cognitive-emotional learning media theory and derived empirical support for the principles of instructional design: guided activities, reflection, feedback, control, and pre-training through experimental research, providing directions for future research on instructional technology.

Scholar Steffi Heidig (2015) in her article 'Emotional design in multimedia learning: differentiation on relevantdesign features and their effects on emotions and learning" found through quantitative research that objective differences in aesthetics or usability did not affect learners' emotional states. However, learners' perceptions of aesthetics and usability positively affected their emotional states. Learners' emotional states had less impact on learning outcomes, but more impact on learners' intrinsic motivation.

In Cluster #3, based on scholar Richard E. Mayer's 2014 book Benefits of emotional design in multimedia instruction ", a representative article that found, through comparative experiments, that the affective design of multimedia instruction involves making basic elements of course graphics more appealing. These findings are broadly consistent with cognitive theories of emotion in media studies and emphasise the importance of incorporating motivational factors into cognitive theories of multimedia learning.Brom c, 2018, 'How effective is emotional design? a meta-analysis on facial anthropomorphisms and pleasant colours during multimedia learning", the study confirms that adding anthropomorphic faces and/or adding pleasant colours to multimedia graphics is an effective approach to emotional design. Cognitive Load Theory was developed by John Sweller in 2011. This theory explores cognitive load in human learning and cognitive processes and advocates improving learning by reducing the cognitive load of learning tasks. It focuses on three types of cognitive load: intrinsic cognitive load (determined by task complexity), extrinsic cognitive load (the learner's interaction with the learning material), and dispositional cognitive load (the learner's interest and motivation in the task). This theory has been an important guide to the design of education and learning, contributing to the development of, for example, instructional design and the way materials are presented. Meta-Analysis of Emotional Designs in Multimedia Learning: a Replication and Extension Study was conducted by Rachel M. Wong in 2021. This study replicates and extends a previous meta-analysis of emotional designs in multimedia learning. The study explored whether adding anthropomorphic faces and pleasant colours to multimedia graphics was an effective approach to affective design. The results suggest that these design approaches have positive effects on learning aspects such as retention, comprehension, and transfer. However, the effects varied in terms of affect and motivation, with significant positive effects on intrinsic motivation, weaker effects on preference/enjoyment, and more marginal effects on positive emotions. The study also found that these design manipulations did not significantly affect perceptions of learning or effort, but did reduce learners' perceptions of difficulty. Overall, this study supports the positive role of affective design in multimedia learning and provides valuable insights into educational design and learning strategies. Learning with human and virtual instructors who display happy or bored emotions in video lectures is a study conducted by Horovitz et al. in 2021. The study examines learning with human and virtual instructors who display happy or bored emotions in video lectures. The study focuses on the effects of lecturers on learners in different emotional states. The results of the study may involve findings on the effects of lecturer emotions on learners' learning outcomes, affective experiences, and cognitive impact on the course.

CONCLUSION

Emotional design research has shown a general upward trend in terms of time-series paper output, but the growth has been slow. There are not many countries/regions, institutions and scholars with high output during the decade’s years of development, and research collaboration is mostly intra-institutional, with a fragmented distribution. Through the keyword clustering study, it can be found that affective design is very comprehensive and diversified in terms of research content, which can be mainly divided into five major clusters, which together constitute the hot research areas and themes of affective design with a wide range of connotations. These clusters include education, psychological cognition, interaction, product and user experience, and reflect the characteristics of "user-centred", emphasizing the subjective feelings of people.

From the time-keyword clustering and Burst Term2 dimensions, it is concluded that the future research hotspots of emotional design are multimedia learning, feature and product, etc., and more attention is paid to the identification and expression of users' personalised and differentiated emotions. Analysing the citation network of references, it can be found that the research on affective design has been relatively mature, and in the long process of development, affective design has drawn on a large amount of interdisciplinary literature and knowledge, and has produced a number of classic literature and formed three mainstream theoretical systems. The research methodology includes both abstract and psychological methodological research,And theoretical research on human factors and engineering technology, such as perceptual engineering and emotional computing. They have played an important role in the emergence and development of emotional design research as important research methods and paradigms.

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