Children's Affective Attitudes Towards Bronze Drum Culture : An Effectiveness of Different Animation Technologies

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Abstract

Animation technologies are extensively utilized within the realm of Bronze Drum Culture (BDC), yet there exists a dearth of empirical evidence concerning the efficacy of various animation technologies in shaping children's affective dispositions toward BDC. This study endeavours to scrutinize the comparative impacts of different animation technologies on children's affective attitudes toward BDC, discern children's technological preferences as perceived by parents, primary educators, and children themselves, and ascertain the determinants influencing children's affective attitudes. The research employed 2D and 3D animation technology, 2D interactive technology, and VR panoramic technology, all centred around the BDC theme, as research stimuli. Semi-structured interviews were conducted with 24 children aged 7-10 from Guangxi, along with 11 parents and two primary school teachers. Grounded theory analysis and Nvivo 12 software were employed for data analysis. The findings underscored the significant impact of animation technology on children's affective attitudes toward BDC, particularly in kindling their interest. Consensus emerged among stakeholders that 2D interactive games and 3D animation constituted the preferred technological types among children. Attributes such as interactivity, immersion, stereoscopy, content quality, engagement, and knowledge dissemination were identified as pivotal requisites for eliciting children's affective attitudes toward BDC, while perceived knowledge value and personal interest were recognized as internal catalysts for

fostering positive affective attitudes. This study advocates for the utilization of "3D animation combined with interactive technology" to cultivate children's positive affective attitudes toward BDC, while cautioning against an excessive emphasis on knowledge content or complexity that may impede engagement.

Keywords: Animation Technology, Children, Bronze Drum Culture, Affective Attitudes, Effectiveness.

Introduction

Background

The bronze drum holds significant cultural importance as a carrier of ancient traditions in southern China and Southeast Asia, documenting the achievements of ethnic minorities across various domains such as casting, music, art, dance, and religion, thus constituting the quintessential Bronze Drum Culture (BDC) (Li et al., 2021; Wan & Wei, 2018). Its development and evolution epitomize the symbiotic relationship among diverse ethnic cultures, enriching the essence and manifestations of BDC while facilitating the dissemination and integration of different ethnic groups. Nevertheless, contemporary aesthetic sensibilities have led to a lack of understanding of BDC among 75% of young individuals, who perceive it as uninteresting and rigid (Lin et al., 2022; Ren, 2023; Wei et al., 2023; Wu et al., 2023). Consequently, BDC faces a gradual decline and is at risk of being forgotten. Although primary school students are at a formative stage where their awareness of China's intangible cultural heritage is nascent, this period represents a crucial juncture for nurturing aesthetic appreciation and fostering a positive mindset towards artistic learning (Plass & Kaplan, 2016).

To safeguard and propagate BDC, scholars advocate for the utilization of animation technology, such as 2D and 3D animation, as a means of dissemination and preservation, particularly targeting young audiences (Huang，Y & Yi, 2018). This approach is rooted in the belief that judicious use of technology can evoke emotional resonance, stimulate imagination, establish personal connections, and foster deeper

engagement and participation among viewers. Positive affective attitudes, in turn, are known to influence behavioural intentions and actual behaviours. However, there remains a dearth of research examining children's affective responses to BDC under the influence of animation technologies.

Prior research has delved into the interplay between animation technology and affective attitudes (Paredes-Velasco et al., 2023; Plass et al., 2014; Redweik et al., 2017; Schubertová et al., 2023; Zheng et al., 2023). According to Zheng et al. (2023), students exhibited a preference for animated videos (average score = 3.2). Furthermore, as proposed by Paredes-Velasco et al. (2023), the amalgamation of augmented reality (AR) and visualization engendered significantly more positive emotions than negative emotions among students, with a concurrent reduction in boredom. Similarly, within the domain of cultural heritage, 72% of respondents perceived digital cultural heritage themes as serving scientific heritage purposes (Redweik et al., 2017). These findings find support in Plass et al.'s (2014) assertion that shape and colour are pivotal design elements that evoke affective responses. Nevertheless, divergent viewpoints exist among scholars. Some contend that while animation piques the interest of preadolescent children, it fails to sustain situational interest (Schubertová et al., 2023). Consequently, the efficacy of animation technology in shaping children's affective attitudes remains contentious.

Moreover, while most scholars espouse a positive stance regarding the role of animation technologies in affective attitudes, they have yet to investigate variances in affective attitudes across different technologies. Therefore, this study endeavours to elucidate the impact of Children's Affective Attitudes toward Bronze Drum Culture (CsAA-BDC) under the influence of various animation technologies.

Theoretical Background

This study employed the Social Cognitive Theory (SCT) and Media Effects to investigate the effects of CsAA-BDC on children, their preferred technology, and the influencing factors thereof. Drawing on prior literature conceptualization of triadic

reciprocal causation within the SCT framework, media, as a form of symbolic modelling within environmental factors, can impact personal and behavioural dimensions. Emphasizing affect as a crucial component within personal factors, the study adopts a perspective rooted in media effects theory, which posits that human communication serves deliberate purposes. Media effects encompass the psychological, attitudinal, and behavioural alterations induced by newspapers, radio, and television on individuals and society. A prior study further delineates affective effects as encompassing the acquisition, triggering, alteration, and reinforcement of emotions. Consequently, this study examines the changes in affective attitudes among children before and after watching animations, specifically analysing the acquisition, triggering, alteration, and reinforcement of affect. The theoretical framework depicted in Figure 1 outlines Bandura's SCT, comprising personal factors (with a focus on affective attitudes in this study), behavioural factors, and environmental factors. This model serves as the foundational framework for conducting the quasi-experimental study in a theory-driven manner. Additionally, the inclusion of media effects change in two separate boxes enables the comparison of various dimensions of change based on data-driven analysis.

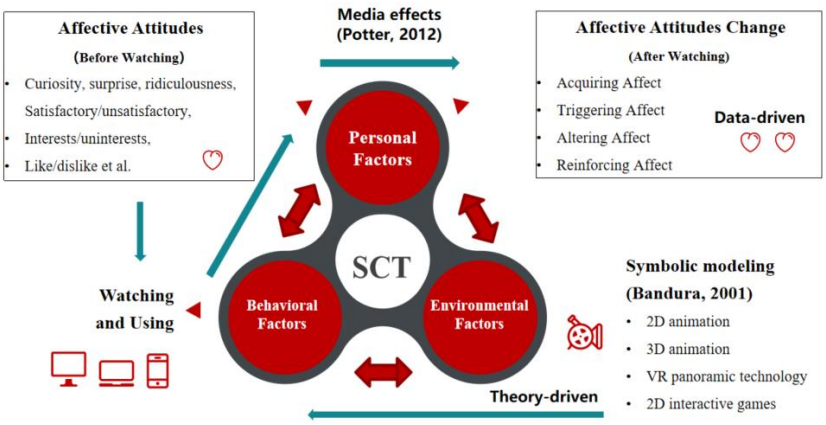

Figure 1: The Theoretical Framework of Children's Affective Attitudes Change.

Significance of the Study

It holds considerable importance to investigate the affective attitudes elicited by various animation technologies among children, particularly in safeguarding and

proliferating cultural and digital content (BDC) (refer to Figure 2). Firstly, understanding the affective attitude impact of different animation technologies on children offers a theoretical framework for guiding the dissemination of BDC applications. Secondly, discerning children's preferences regarding animation technology aids animation designers in precisely localizing content, refining design techniques, aligning with audience preferences, enhancing satisfaction with animated works, and improving the communication effectiveness of BDC. Lastly, existing research on animation techniques predominantly adopts quantitative approaches, overlooking qualitative exploration (Yusuf & Noor, 2023). Thus, this study seeks to address the dearth of qualitative research on CsAA-BDC, bridging this research gap.

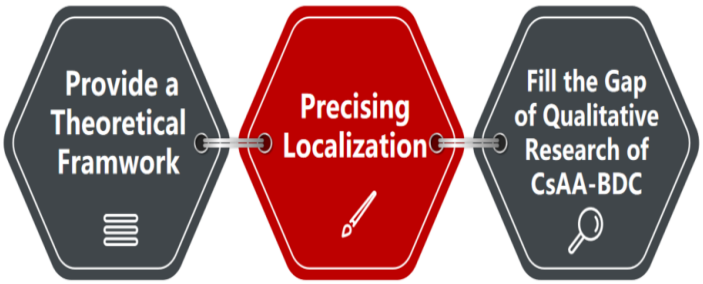

Figure 2: The Significance of the Study.

Structure of the Study

The structure of this study comprises five distinct sections (refer to Figure 3):

Firstly, the study provides an introduction covering the background, theoretical underpinnings, significance, structure, and research questions. Secondly, a literature review is conducted, encompassing topics such as animation technology, affective attitudes, changes in affective attitudes, factors influencing these attitudes, qualitative methodology, and the Delphi technique. Thirdly, the methodology is outlined, including the selection process for research materials, data collection methods, data analysis procedures, ethical considerations, and a theoretical saturation test. Fourthly, the study presents and discusses its findings, addressing each research question in detail. Finally, the conclusion section offers overall conclusions drawn from the study and provides suggestions for future research endeavours.

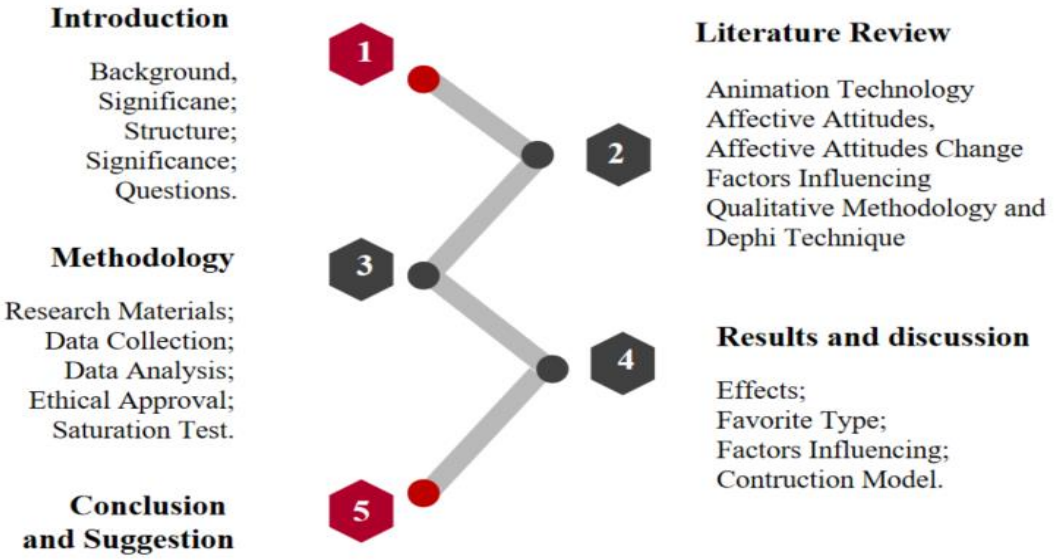

Figure 3: The Structure of this Study.

Research Questions

In accordance with the preceding research background and theoretical framework, this paper primarily addresses the following research inquiries:

RQ 1: What impacts do various animation technologies have on CsAA-BDC?

RQ 2: Considering viewpoints from parents, primary teachers, and children, which genre of animation technology garners the most favour among children?

RQ 3: From the vantage point of children themselves, what factors exert influence on animation technology concerning CsAA-BDC?

RQ 4: What roles do distinct factors play in the context of CsAA-BDC?

Literature Review

Animation Technology

Animation has long been utilized as an educational tool in pedagogy (Sugiharti et al., 2020; Yogha et al., 2021) due to its ability to offer lucid explanations of subject matter, thereby enhancing students' interest, motivation, and comprehension in learning endeavours (Puspaningtyas & Ulfa, 2020). Facilitating the learning process necessitates the integration of technology capable of accommodating diverse learning

styles, thereby facilitating comprehension of educational material (Puspaningtyas et al., 2020). According to extant literature, animated technology encompasses various forms such as animation videos (Hidayat et al., 2022), 2D Animation Technology (2D-AT) (Krieglstein et al., 2023), 3D Animation Technology (3D-AT) (Kumar et al., 2023), interactive technology (Amorim et al., 2023), VR technology (Paredes-Velasco et al., 2023), AR technology (Peeters et al., 2023), among others. Animation technology allows for the simultaneous processing of visual, auditory, and tactile information, surpassing the sole reliance on visual information characteristic of traditional media, thereby enhancing audience understanding and comprehension of the world. Consequently, scholars advocate for the maximization of animation technology, advocating for the establishment of databases and the enhancement of record-keeping, publicity, and dissemination of BDC to new technological heights (Wei et al., 2023). Xue et al. (2023) propose the utilization of VR and augmented reality (AR) technology to provide students with immersive experiences, enabling them to tangibly experience the allure of BDC. Furthermore, interactive games incorporating challenges, such as puzzles and audio recognition, are designed to stimulate interest and active engagement in learning, reinforcing acquired knowledge. Additionally, scholars advocate for the use of 3D animation technology, 360-degree panoramic technology, and other innovations (Wei et al., 2023) to safeguard and disseminate BDC. The consensus among many scholars is that leveraging animation and digital platforms is imperative for revitalizing traditional BDC in contemporary culture (Xiong & Qiu, 2019). While scholars contend that 2D-AT, 3D-AT, 2D-IT, or VR-PT can cultivate positive affective responses toward BDC among children, there is a dearth of comparative analyses regarding the efficacy of these technologies on affective attitudes. Determining the most effective technology warrants scrutiny, given the impracticality of employing all available technologies simultaneously. Just as Schunk and DiBenedetto (2020) advocate for social cognitive research utilizing social media platforms, it remains unclear which media variables effectively foster social interactions among students.

Affective Attitudes

The conceptualization of attitude, as delineated by the American Psychological Association (VandenBos, 2007), encompasses a relatively enduring and generalized assessment of an object, individual, collective, topic, or abstraction along a continuum from negative to positive. These evaluations serve as concise summaries of targeted entities and are commonly perceived to stem from particular beliefs, affective states, and prior behavioural engagements associated with said entities (Cherry, 2018; VandenBos, 2007). In psychological discourse, an attitude denotes a composite of affective, cognitive, and behavioural elements directed toward a specific object, individual, entity, or occurrence. Attitudes are frequently moulded by experiential learning or societal upbringing and wield significant influence over behavioural responses (Bohner & Dickel, 2011; Jain, 2014).

Although attitudes are not directly observable, their assessment often relies on explicit self-reports or implicit reaction-time measures (Bohner et al., 2011). These attitudes evolve over time through learning processes and are shaped by individual dispositions and social affiliations (Jain, 2014). The tripartite model of attitude posits affective, cognitive, and behavioural dimensions (Simpson et al., 1994). The affective facet encapsulates emotional reactions (favourable/unfavourable) toward the object of attitude, while the cognitive facet entails evaluative judgments (acceptance/rejection) concerning the object. The behavioural facet manifests as verbal or nonverbal behavioural predispositions induced by the attitude object (Jain, 2014). A seminal theory elucidating the interplay between general attitudes and behaviour is the theory of planned behaviour. This theory underscores both cognitive and affective components within attitudes. Notably, investigations into attitudes toward technology education predominantly emphasize the affective dimension (Svenningsson et al., 2022). Therefore, this study centres on affective attitudes, particularly focusing on positive affective states such as joy, interest, contentment, and love. Bem (1970) posits that attitudes fundamentally reflect individual preferences, encapsulating one's 'likes and dislikes.' Notably, interest, construed as an emotional

schema, encompasses both affective and cognitive dimensions (Svenningsson et al., 2022). Ainley (2006) also conceptualizes interest as an affective state reflective of students' subjective learning experiences. Additionally, Cowen and Keltner (2017) identified various emotional experiences, including satisfaction, curiosity, delight, and surprise, elicited during learning sessions (Calvo & D'Mello, 2011). These emotional nuances underscore the intricate interplay between affective attitudes and educational engagement.

Primarily, the study concentrates on affective attitudes concerning overarching evaluations of behaviours (e.g., assessing positivity or negativity) (Kraft et al., 2005). Specifically, it delves into the affective component encompassing emotions such as curiosity, surprise, amusement, satisfaction/dissatisfaction, interest/disinterest, and likes/dislikes, among others.

Affective Attitude Change and Factors Influencing

Attitudes, though enduring, are subject to change (Cherry, 2018). This change entails a shift in an individual's general evaluative perception of a stimulus or stimuli, encompassing alterations in enduring favourable or unfavourable regard for a person, object, or issue (Cacioppo et al., 1994). Within a memory-based framework, it's proposed that both old and new attitudes may coexist, leading to multiple attitude representations for the same object. In this study, affective attitude change will be gauged through exposure to animated BDC materials.

Beyond the BDC context, various factors influence affective attitudes, including internal and external causes, knowledge, goals, bodily attitudes, perceived usefulness, communication quality, curiosity, trust, satisfaction, playfulness, external and interpersonal influence, cognitive demands, perceived value, multimedia experience, thought favourability, presence, gender, and graphic design (Bernaus et al., 2007; Besoain et al., 2022; Bohner et al., 2011; Calvo et al., 2011; Hui et al., 2022; Hung et al., 2015; Pang, 2021; Russell, 1980; Svenningsson et al., 2022). This underscores the multifaceted nature of factors shaping affective attitudes, a phenomenon likely

mirrored in the technical milieu of bronze culture animation.

Limited research has explored the determinants shaping affective attitudes towards cultural heritage within the realm of animation technology exposure. Gatto et al. (2022) noted that virtual reality-based scenarios exert a more positive impact on user happiness and arousal levels, with greater efficacy in alleviating distress. Similarly, Besoain et al. (2022) observed that attitudes towards heritage can undergo change contingent upon multimedia experiences, thought favourability, and presence, indicating that diverse technological encounters influence audience affective dispositions. Conversely, Lai et al. (2009) demonstrated that while mobile animation enhances product recall and perceived value across hedonistic and utilitarian dimensions, it fails to enhance attitudes towards more utilitarian products, underscoring that animation technology deployment may not uniformly influence audience emotional attitudes towards product content. Furthermore, Unal-Colak and Ozan (2012) found no notable discrepancy in student attitudes towards various animation teaching agents; however, attitudes towards agents featuring live body shots were notably positive, suggesting a preference for animated characters despite negligible differences in agent characteristics. This implies that animated character modelling may indeed impact student affective attitudes, albeit animations devoid of characters also elicit emotional responses, hinting at additional factors beyond character modelling influencing emotional attitudes. Consequently, this study endeavours to delineate the factors influencing divergent animation technologies on CsAA-BDC.

Qualitative Methodology and Delphi Technique

Current research on affective attitudes predominantly adopts quantitative methodologies (Yusuf et al., 2023), often focusing on adult or older child participants (age ≥12) (Bernaus et al., 2007; Svenningsson et al., 2022). However, there exists a dearth of empirical evidence concerning assessment within secondary and primary school contexts and the utilization of qualitative approaches. It has been noted that children's affective attitudes are intertwined with both cognitive facets and

behavioural intentions (Svenningsson et al., 2022). Attitudes towards cultural heritage exhibit variability in response to multimedia experiences, thought goodwill, and presence (Besoain et al., 2022). Nonetheless, further qualitative inquiry from a distinct perspective is imperative to comprehend children's affective attitudes and scrutinize their determinants. Previous research suggests that peer influence (Laursen & Veenstra, 2021), media exposure (e.g., animated agents) (Unal-Colak et al., 2012), and multimedia encounters (Besoain et al., 2022) may shape children's affective attitudes. Therefore, it is paramount to investigate factors influencing CsAA-BDC through the lens of children themselves. In light of this, the present study employs qualitative research methodologies to explore CsAA-BDC and its determinants. The Delphi method, a systematic approach utilized by experts to glean insights on contentious topics with limited information (Beiderbeck et al., 2021), is employed. Notably, Delphi Technology serves as a widely adopted tool in psychological emotion analysis. Given the necessity for varied animated BDC materials and the attendant uncertainty stemming from diverse technologies, collective expert opinion and evaluation assume heightened significance (Beiderbeck et al., 2021). Thus, the Delphi survey technique is utilized to select animated BDC materials for the study.

Methodology

The study aims to employ the Delphi approach to select four distinct animation technologies for the BDC as research materials (Mengual-Andrés et al., 2016). Subsequently, grounded theory methodology and Nvivo 12.0 software will be utilized to analyse interview data collected from children, parents, and primary school teachers.

Selection of Research Materials

The selection of animation technologies followed two preliminary phases. Initially, a Delphi method involving four experts was employed to ensure that the content of the research materials aligned with the study's requirements. Subsequently,

four types of animation technologies were finalized: the 2D animation "The Legend of Bronze Drum" (Episode seventh) (Figure 4. A), the 3D animation "The Bears of Global Adventure- Bronze Drum Festival" (Figure 4. B), the 2D interaction technology "The Power of Bronze Drum" (Figure. 4. C), and the VR panoramic technology "BDC museum" as experimental materials (Figure 4. D).

In the subsequent phase, the structure of interviews with children was established following consultations with experts. The interview protocol encompassed inquiries such as: "Prior to viewing these materials, what were your sentiments toward the BDC? To what extent did you favour or disfavour it, and why?" "Have your affective attitudes toward the BDC altered subsequent to experiencing these technologies? If so, what prompted this change, and how?" "Do you find these technologies satisfactory in depicting the BDC? Which aspects of the animation technologies do you find satisfying or dissatisfying, and why?" Concurrently, an interview framework for parents and primary school teachers was formulated, addressing queries such as: "Have you noticed any shifts in your child's sentiments toward the BDC following exposure to these materials? In what manner have these sentiments changed, and why?" "Which animation technology do you perceive as your child's preference, and what factors contribute to this preference? Do you have any recommendations for leveraging animation technology to enhance CsAA-BDC?".

A: 2D animation "The Legend of the Bronze Drum"(Screenshots)

B: 3D animation titled "Bear's Global Adventure Bronze Drum Festival"(Screenshots)

C: VR Panoramic Photography BDC Museum "(Screenshots)

D: 2D Interactive Games "The Power of Bronze Drum"(Screenshots)

Figure 4: Animated BDC Materials.

The Process of Data Collection

Children aged 7-10 residing in Guangxi were selected randomly for participation in the study. Interviews were excluded from formal analysis if children voluntarily withdrew from the interview, had not previously viewed the BDC animation materials, or if the interview content contained exaggerated statements.

The survey process for children was delineated into three phases (Figure 5). In the first phase, researchers-initiated contact with parents of children within the specified age range via QQ, WeChat, face-to-face, or telephone communication. Subsequently, researchers communicated the research objectives, inquiries, animated BDC materials, and procedures. Parents provided consent by signing a consent form and finalized the date and method for their child's interview. In the second phase, during the interview, (1) explicit consent was obtained from both children and parents for recording purposes; (2) assurance was provided that the interview recordings were strictly for academic research purposes; (3) the sequence and content of questions were adjusted flexibly based on the interview outline and actual conversation; (4) researchers monitored the tone and intonation of children's responses, actively listened, provided feedback, and offered encouragement; (5) parents were reminded not to interject during the children's responses and to engage effectively with the respondents. Finally, the interview data were processed for analysis.

Furthermore, prior to the formal interviews, researchers ensured that children had viewed the four distinct types of animation materials either on their parents' mobile phones or computers. Interviews were primarily conducted through WeChat voice and video calls, QQ video calls, telephone conversations, or face-to-face interactions. The average duration of interviews with children ranged between approximately 20 to 30 minutes. Subsequently, 20 records were randomly selected from the collected data for coding analysis, while the remaining four interview records were retained for a theoretical saturation test.

Parents and primary school teachers were interviewed subsequent to randomly selecting parents of the participating children. These interviews took place 1-2 months after the children's interviews, allowing parents ample time to observe and gauge their children's sentiments towards the BDC. The interview method with parents and teachers also utilized WeChat video and voice calls, or QQ voice and video calls in an online format. All interview content was recorded in audio format and subsequently transcribed into Word documents. These transcripts were then shared with the interviewees to verify the accuracy and credibility of the interview content. The data

collection process is illustrated in Figure 4.

Figure 5: The Process of Children, Parents and Primary School Teachers Interview.

Data Analysis

This research employed Proceduralized Grounded Theory (Strauss, 1987), a qualitative method, to manage the data. Its primary aim is to formulate theories based on interview data. Within the realm of qualitative inquiry, Grounded Theory is esteemed as the most scientific approach, often considered the most suitable method for theoretical construction within sociology (Guba et al., 1994). Central to Proceduralized Grounded Theory is the elucidation of conceptual direction, where changes in orientation yield new conceptual interpretations. These shifts persist until conceptual saturation is attained, a consequence of varied directional interactions. Coding entails the identification and labelling of diverse conceptual categories. Proceduralized Grounded Theory delineates the coding process into distinct stages such as open coding, axial coding, and selective coding (Strauss, 1987). The phases of Proceduralized Grounded Theory analysis are depicted in Figure 6.

Figure 6: The process of Data Analysis.

Ethical Approval

Prior to participant recruitment, this study comprehensively briefed the parents of potential participants on the study's objectives, inquiries, materials, and procedures. Subsequently, all parents provided written consent before their children's interviews commenced. Furthermore, to safeguard the privacy of all interviewees, their identities were anonymized or replaced with numerical identifiers. Ethical approval for this study was granted by the Jawatankuasa Etika Penyelidikan Manusia Universiti Sains Malaysia (JEPeM-USM) (No. 23080656). Participation in the study was entirely voluntary, and participants retained full autonomy in deciding whether to partake in this anonymous investigation.

Theoretical Saturation Test

According to Hennink et al. (2017), achieving higher degrees of meaning saturation typically requires 16-24 interviews, while outcomes of a prior study identified that data saturation can occur between 7-12 interviews. In this study, an initial target of 16 interviews was set, with a stopping criterion of 3 (Francis et al., 2010). However, the study proceeded to interview the 20th child and 11th adult participant, at which point meaning saturation was attained. Nevertheless, to ensure accurate meaning saturation, an additional 4 children and 2 adults were interviewed, resulting in a total of 24 children and 13 adults being included in the study.

Results and Discussion

No novel themes emerged from the interviews conducted with the 24 participants. The study cohort consisted of individuals hailing from three cities (Nanning, Liuzhou, Guilin) within the Guangxi Zhuang Autonomous Region, China. Demographic data pertaining to the children involved in the study are presented in Table 1. On average, the interviews lasted for 20 minutes each. The children participants comprised 13 boys and 11 girls. Among them, 3 (12.5%) were in grade one, 6 (25%) were in grade two, 5 (20.83%) were in grade three, 4 (16.67%) were in

grade four, and 6 (25%) were in grade five.

Table 1: Demographic Statistics of Children.

Demographic	Genders		Grades				
	Boys	Girls	Grade One	Grade Two	Grade Three	Grade Four	Grade Five
Sample number	13	11	3	6	5	4	6

The demographic characteristics of the parents and primary school teachers are delineated in Table 2. Thirteen interviews were conducted in total (Male=3, Female=10), with an average duration of 30 minutes per interview. Among the participants, 8 (61.54%) held a bachelor's degree, 3 (23.08%) held a master's degree, and 2 (15.38%) held a Ph.D. Additionally, 7 (58.33%) of the participants were teachers, 2 (15.38%) were employees, 1 (7.69%) was a nurse, 1 (7.69%) was a civil servant, 1 (7.69%) was engaged in entrepreneurship, and 1 (7.69%) did not specify an occupation. Utilizing grounded theory, the study identified initial concepts and categories through coding.

Table 2: Demographic Statistics of Parents and Primary School Teachers.

Name	Age	Gender	Education Degree	Work	Children
A1	38	Female	Master	Civil servant	P05
A2	36	Female	Bachelor	Nurse	P02
A3	38	Female	Master	Teacher	P13, P14
A4	38	Male	Bachelor	Teacher	P19
A5	42	Female	Ph.D	Teacher	P06
A6	41	Male	Master	Teacher	P10
A7	33	Male	Bachelor	Entership	P09
A8	39	Female	Bachelor	Employee	P20
A9	33	Female	Bachelor	None	P8, P23
A10	33	Female	Bachelor	Employee	P16
A11	41	Female	Ph.D	Teacher	P24
A12	26	Female	Bachelor	Teacher	210 children
A13	27	Female	Bachelor	Teacher	35 children

Effects of Animation Technology on CsAA-BDC

In this study, data analysis employed the grounded theory coding analysis method, facilitated by Nvivo 12 software. We conducted a comparison of the frequency of reference coding points among children who were exposed to different animation techniques. Furthermore, we evaluated alterations in affective attitudes

among children subsequent to exposure to the BDC animation, based on coding frequency. The outcomes of these analyses are depicted in Figures 7 and 8.

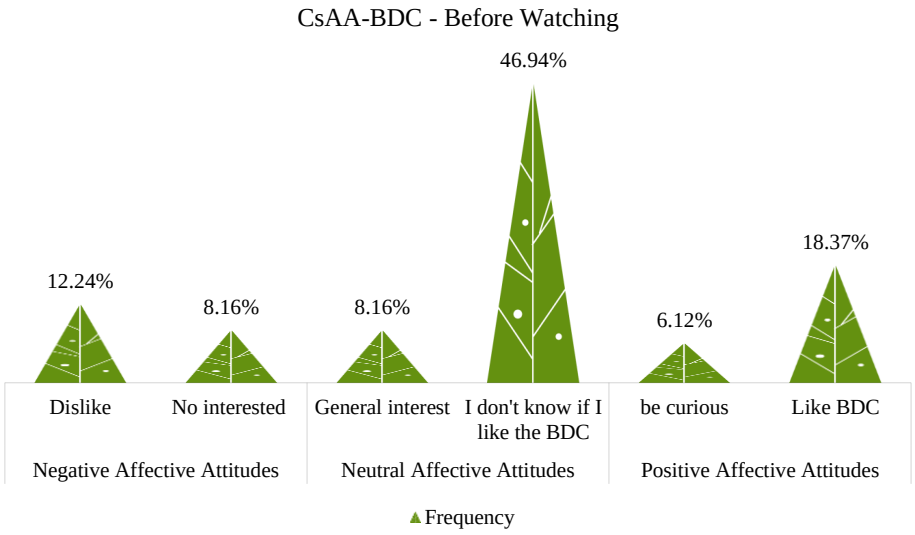

Figure 7: Children's Affective Attitudes towards BDC - Before Watching.

As depicted in Figure 7, the predominant affective attitude among children was neutral (55.1%), followed by positive attitudes (24.49%) and negative attitudes (20.4%). These findings suggest that prior to viewing the animation technologies, a considerable portion of children displayed either indifference or aversion toward the BDC. This observation implies that many children might have had limited familiarity with the concept of the BDC, highlighting the significance and pertinence of this study.

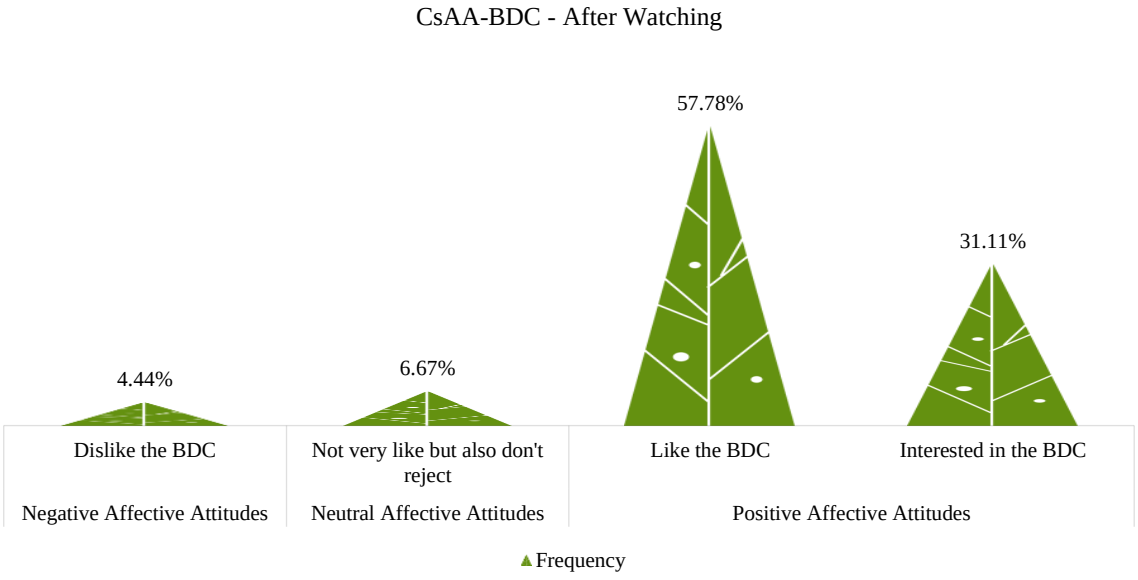

Figure 8: Children's Affective Attitudes towards BDC - After Watching.

Figure 8 illustrates the alterations in CsAA-BDC subsequent to exposure to the animation technologies. There was a marked increase in the proportion of reference coding points associated with positive affective attitudes, rising notably from 24.49% to 88.89%. Conversely, the proportion linked to negative attitudes decreased from 20.4% to 4.44%. Furthermore, there was a notable decline in the proportion of reference coding points corresponding to neutral attitudes, dropping from 55.1% to 6.67%. Following exposure to various animation types, children demonstrated an elevation in positive affective states alongside a gradual reduction in negative and neutral affective states.

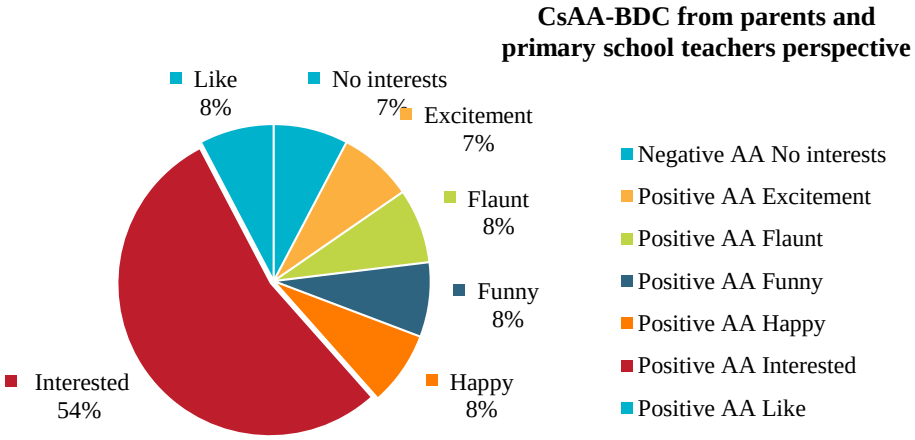

Figure 9: Children's Preferred Animation Technology from Perspective of Parents and Primary School Teachers.

As indicated in Figure 9, children perceive learning BDC knowledge through animation as engaging and enjoyable during their viewing process. Consequently, they experience positive affective responses when utilizing animation for learning BDC. A child expressed, "I am interested in the sun motif... I will ask my mother to download the BDC animation and games, I will continue to watch the animations and play games, I am interested in BDC and these technologies." (Participant 03, male, 8 years old). Moreover, parents and primary school teachers also observed a positive shift in children's affective attitudes, particularly towards their interest in BDC. Fifty-four percent of them noted that their children showed an increased interest in BDC

after viewing animated BDC materials. As articulated by two parents, "More interested, and after learning that she was very interested in" (Participant A10, Parent) and "There are, small children will be more interested in how people used it in ancient times" (Participant A5, Parent). One potential reason for children's interest in BDC could be attributed to the engaging storyline, audio-visual effects, vibrant colours, humorous characters, interactive technology, and three-dimensional perception, which are familiar and appealing to them. This observation aligns with prior study in which results describe that children are more drawn to cartoon content than traditional learning methods due to its vivid scenes, auditory and visual effects, and colourful presentation. Additionally, the positive impact of affective interest is supported by Schubertová et al. (2023) finding that animated videos can stimulate children's interest.

Children's Favourite Type of Animation Technology

In accordance with the methodological framework of Research Question 1 (RQ1), the analytical tool Nvivo 12 was utilized to systematically analyse and categorize the data, incorporating input from children, parents, and primary school teachers. The outcomes of the coding frequency analysis are delineated in Figure 10.

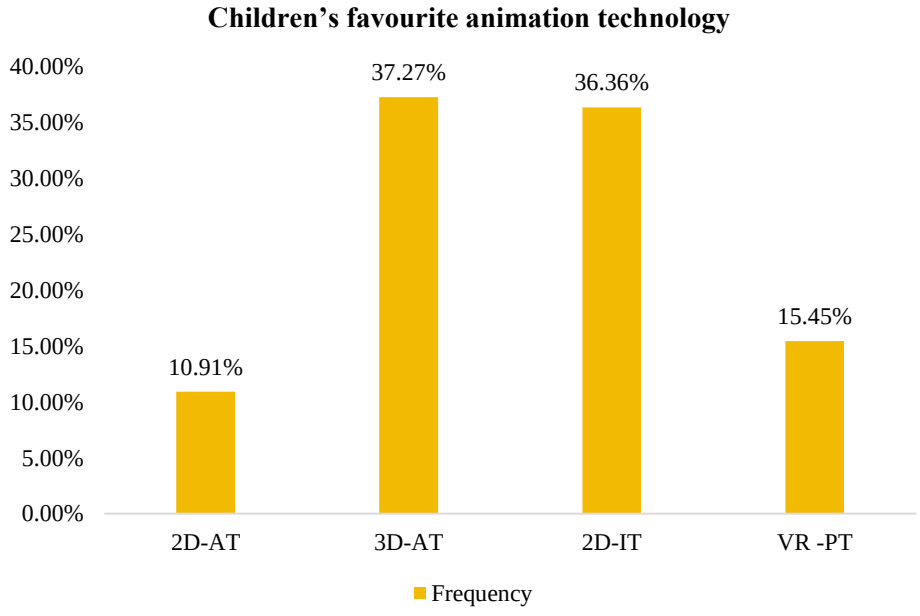

Figure 10: Children's Favourite Animation Technology.

Figure 10 depicts the technologies that children identified as their most preferred following exposure to animated BDC materials. Among these, 3D-AT and 2D-IT emerged as the top favourites, constituting 37.27% and 36.36% of responses, respectively. Following closely is VR-PT (virtual reality technology), representing 15.45% of preferences, and lastly, 2D-AT (2D animation technology), which accounted for 10.91% of responses. These findings suggest a nuanced difference in frequency between children's preferences for 3D and 2D interactive small game technology, with a stronger inclination towards 3D animation technology.

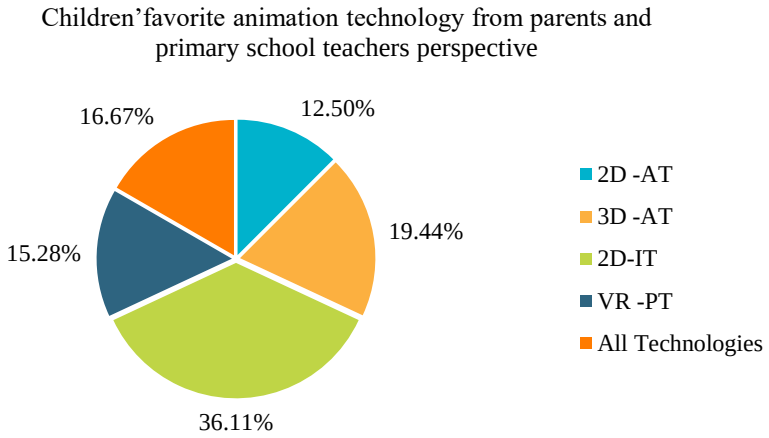

Figure 11: Children's Favourite Animation Technology from Perspective of Parents and Primary School Teachers.

Figure 11 reveals that 2D-IT (36.11%) is the preferred technology among children, as reported by parents and primary school teachers. Following closely is 3D-IT (19.44%), with 2D-AT (12.5%) being the least favoured. In line with children's preferences, parents and teachers perceive 2D-IT as the favoured technology for children, as it combines learning with interactive experiences, enhancing their impression of BDC positively. A primary school teacher noted, "They still don't know what VR is, they are too young...the game can certainly be enjoyed by children, just like 2D-IT. All of them like it and can leave a strong impression" (Participant A12, Primary school teacher). However, children themselves express a preference for 3D-AT and 2D-IT, as games offer rewards and motivation, fostering their interest. One child remarked, "My favourite type is 3D animation. I can see the changes in different scenes in 3D, which is authentic...I am very

happy in this situation, and it is perfect" (Participant 01, Girl, eight years old). This finding aligns with prior literature, that digital gaming effectively engages children and young people. Thus, designers should prioritize the use of 3D-AT and 2D-IT to bolster children's positive attitudes toward BDC.

Factors Influencing CsAA-BDC from Children's Perspective

Within this study, the collected data underwent rigorous analysis and synthesis, culminating in the delineation of 20 initial concepts and 9 distinct categories. The outcomes derived from the open-coded data are systematically presented in Table S1. Subsequently, employing axial coding predicated on the findings of open coding, yielded 9 categories and 4 overarching main categories, which are comprehensively depicted in Table S2. Further refinement through selective encoding led to the development of insights, succinctly outlined in Table S3. The depiction of the structural model elucidating the factors influencing CsAA-BDC is eloquently presented in Figure 12.

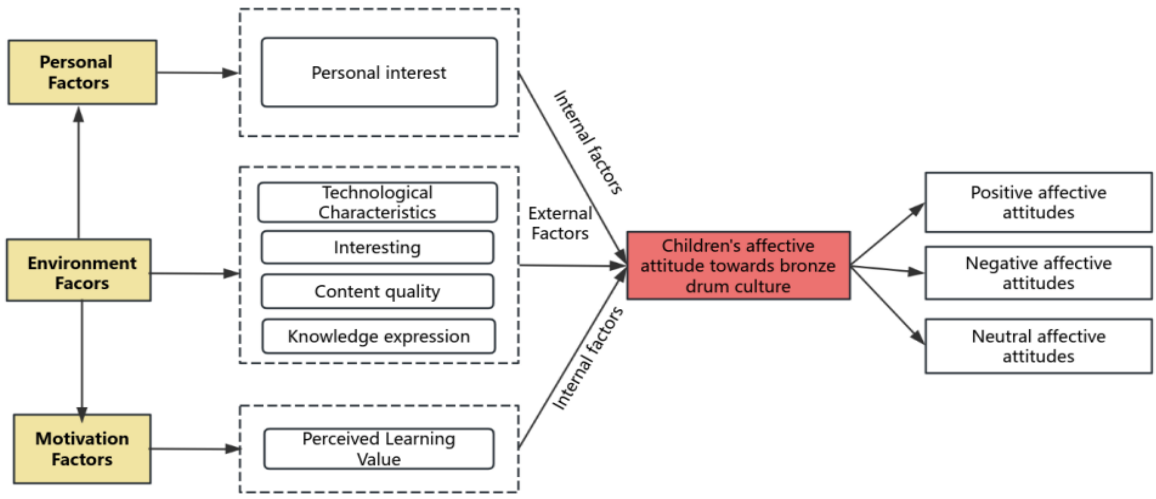

Figure 12: Theoretical modelling of CsAA-BDC.

According to the SCT, the results of axial coding and selective coding in Table S2, Figure 12 depicts the formation of CsAA-BDC, wherein CsAA-BDC is influenced by various factors including personal interests, technological attributes, content quality,

engagement, knowledge articulation, and perceived value. Notably, animated BDC materials serve as environmental stimuli, constituting primary external influences on CsAA-BDC, while personal interests and perceived value act as intrinsic motivators shaping CsAA-BDC. Environmental, personal, and motivational factors directly impact CsAA-BDC. Additionally, environmental factors can indirectly affect CsAA-BDC via their influence on personal and motivational factors.

Creating a Favourable Animation Environment that Enhances Children's Experience and Interest is to Enhance the External Motivation of their CsAA-BDC

This investigation highlights that advantageous animation-related environmental factors, such as technical attributes, content quality, engagement, and knowledge presentation within animations, may serve as extrinsic stimuli for CsAA-BDC. The SOR theoretical framework, as posited by Mehrabian and Russell (1974), emphasizes the substantial impact of external environmental factors on an individual's psychological disposition (Namkung & Jang, 2010). These environmental factors are principal external influencers shaping children's emotional reactions toward BDC and are instrumental in defining their areas of interest.

Primarily, technical attributes, particularly interactivity and stereoscopy, constitute pivotal factors influencing CsAA-BDC. Testimonials from children, exemplified by statements such as "It can help me learn a lot of knowledge, and I can choose by myself, I also like the BDC" (P01, 8-year-old girl) and "My favourite is the flip-dimensional bronze drum, but I don't like the floor design of its board, which does not meet the aesthetic of children" (P06, 9-year-old girl), underscore the significance of robust interactivity and stereo capabilities in enhancing children's experiential immersion. Heightened psychological presence, a consequence of these technical features, mitigates negative perceptions toward cultural heritage (Besoain et al., 2022), a phenomenon corroborated by Sun et al. (2017), whose research revealed a proclivity for interactive digital display formats among audiences. Interactive technologies not only facilitate the absorption of BDC knowledge but also stimulate active engagement

and critical thinking, thereby transmuting passive consumption into an interactive endeavour. Active participation engenders a sense of achievement and fortifies the positive affective dispositions associated with BDC. Importantly, our investigation reveals that while interactivity is instrumental in enhancing children's affective attitudes, stereoscopic perception also contributes significantly to fostering favourable affective states.

Furthermore, this investigation discerns that the quality of content, characterized by captivating narratives, humorous characters, vivid visual and audio effects, and lucid presentation of cultural artefacts, exerts a positive influence on CsAA-BDC. This finding resonates with prior study, that posits that meticulously crafted animations can elicit favourable emotional and cognitive responses from learners. In such interventions, the amalgamation of visual and auditory stimuli enhances the encoding of instructional content while diminishing cognitive load and deliberation associated with learning. Children are drawn to the captivating narratives and derive amusement from the comedic elements within the storyline, thereby fostering a sense of interest and enjoyment. Consequently, exposure to high-quality animated content engenders a positive affective disposition toward BDC. Cultural content developers are urged to transcend the sole emphasis on technical sophistication prevalent in the digital era. Instead, they should prioritize the refinement of content quality and appeal, cognizant of children's cognitive and affective responses, in order to create culturally enriching products more effectively.

Furthermore, a lucid articulation of knowledge is deemed a crucial prerequisite to ensure children's comprehension of cultural heritage content. When children perceive BDC knowledge presented in animated materials as accessible and comprehensible, it fosters positive affective attitudes towards BDC. As articulated by one participant, "Knowledge is made clear. I can catch the knowledge easily. I am happy to learn this knowledge of BDC" (P16, Boy, 9 years old). This observation finds support in the work of Xue et al. (2023), who advocates for digital media technology to augment audience familiarity with intangible cultural heritage rather than serve as a platform for specialized education. Therefore, there is no imperative for exhaustive

academic discourse; rather, clear and easily digestible knowledge content is more likely to elicit positive emotional responses in children.

Personal Interest are an Internal Driver for Development of CsAA-BDC

Regarding personal factors, this study reveals that individual interests, particularly in peculiar phenomena, national culture, and visual stimuli, exert a significant influence on fostering positive CsAA-BDC. Within the current investigation, children demonstrating a keen interest in national culture, fascination with peculiar phenomena, and appreciation for visual stimuli exhibit favourable affective attitudes towards BDC. Testimonies from participants include statements such as "I am interested in national culture and history, very like national culture" (P20, 10-year-old girl), "I like strange things all the time, so I also like the BDC" (P09, Girl, 10 years old), and "More interested in the visual things, from the heart like. I like the BDC because it also looks good" (P20, Girl, 10 years old).

In psychology, the concept of "Cognitive Resonance" posits that individuals tend to positively accept and evaluate information that aligns with their pre-existing beliefs, attitudes, or experiences, a phenomenon referred to as cognitive resonance. This suggests that when individuals share similar characteristics or experiences, they are more inclined to feel a sense of familiarity, thereby fostering positive psychological impressions. Animation, as a medium combining visual and auditory elements, engenders feelings of familiarity and facilitates emotional resonance among children. As emphasized by Hui et al. (2022), visual content leveraging imagery to convey information is particularly effective in evoking emotional resonance.

While children's positive affective attitudes towards BDC may seem primarily influenced by the direct control of technical and content quality, internal factors such as personal interests and affinity also play a significant role. In addition to external environmental stimuli, the alignment and similarity of individual interests contribute substantially to shaping children's perceptions. Put differently, children exhibit greater positivity towards subjects they are already interested in. Hence, animation designers can

enhance children's affinity towards BDC by gaining deeper insights into their interests and creating content that resonates with them, thereby fostering positive sentiments. As highlighted by Svenningsson et al. (2022), interest in technology education emerged as a key determinant of students' attitudinal dispositions.

Perceived Learning Value as an Internal Driver for the Development of CsAA-BDC

In the context of children's engagement with Chinese Ancient Architecture and Bronze Drum Culture (CsAA-BDC), motivational factors, particularly the perceived learning value encompassing usefulness and importance of knowledge, emerge as pivotal determinants. This investigation reveals that the perceived usefulness of knowledge significantly impacts CsAA-BDC engagement. Observations during the viewing of animated BDC materials indicate that children associate the knowledge of BDC with enhanced comprehension of national culture and future academic pursuits, instigating positive affective responses such as interest and affinity. Testimonies from participants underscore this sentiment, with statements highlighting the practical utility of BDC knowledge in understanding traditional culture and its potential relevance in examinations, thus fostering enthusiasm towards learning. This finding aligns with prior research by Gao et al. (2020), which underscores the positive correlation between perceived usefulness and emotional and cognitive engagement among students, particularly emphasizing the role of perceived interest in enhancing satisfaction.

Moreover, the study identifies perceived importance of knowledge as another significant influencer on CsAA-BDC engagement. Participants perceive BDC knowledge as instrumental in deepening their understanding of traditional culture and expanding their cognitive horizons, thus nurturing a sense of fulfilment and eliciting favourable affective responses. Conversely, a lack of perceived importance leads to negative attitudes towards BDC, as evidenced by participants' dismissive remarks regarding its relevance. This observation resonates with Schunk et al. (2020) assertion that perceived importance or usefulness serves as a primary motivator for

children's learning endeavours. Consequently, the study underscores the centrality of perceived value as the primary motivational catalyst driving the cultivation of positive affective attitudes towards CsAA-BDC engagement.

Conclusion and Suggestion

This study, rooted in SCT and Media Effects Theory, offers fresh insights into children's affective attitudes towards CsAA-BDC, their preferred technological mediums, and the factors shaping these preferences. Firstly, it highlights the significant positive impact of animated BDC materials on CsAA-BDC engagement, particularly in terms of generating interest among children. Secondly, based on children's self-reports and feedback from parents and primary school teachers, it reveals that 2D-IT ranks highest among children's favourite technological platforms, followed closely by 3D animation. This underscores the importance for animation designers to prioritize the development of 2D-IT and 3D animation technology relevant to BDC content. Furthermore, the study identifies three overarching themes and six sub-themes influencing various personal, environmental, and motivational aspects of CsAA-BDC engagement. Leveraging these themes and factors, the study suggests proactive measures such as enhancing interactivity, stereoscopic effects, and content quality of animation technology to enrich children's experiential engagement, stimulate their interest, and augment the cultural value of animation content. These efforts aim to instil learning motivation among children and establish a conducive learning environment. It is essential to recognize that enhancing CsAA-BDC engagement necessitates not only intrinsic interest from children themselves and advancements in animation technology and content but also concerted efforts from families and society at large.

This study suggests that combining 3D animation and interactive technology can boost children's interest in learning about BDC. Designers should emphasize both technical aspects like interactivity and content quality. Perceived value motivates children, so early interest cultivation is crucial for positive attitudes toward BDC, promoting its transmission and preservation in cultural communication.

Future research should delve into how children's age and gender influence their affective attitudes towards BDC. Understanding these dynamics is crucial, as the relationships among attitudinal components may vary between girls and boys.

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