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COMPUTER ANIMATED LEARNING INTERVENTIONS FOR SPECIAL NEEDS CHILDREN: AN EFFECTIVENESS STUDY

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Abstract

This study helps to completely understand the extent to which animated teaching materials can improve daily living skills, more particularly brushing and bathing, among children with special needs aged between 3 to 6 years. 30 purposively selected children diagnosed as having Autism Spectrum Disorder (ASD) and Intellectual Disability (ID) formed the subjects of a six-month intervention carried out in Child Guidance Clinics located in and around Mangalore. The intervention was prepared with a view to presenting pictorial detail of self-help routines, through animated videos shaped with chaining techniques. The weekly levels of participation were rated on a five-point system; Kendall's tau-b correlation is used to test improvement.

The results showed a clear and statistically significant enhancement of brushing and bathing skills over time. Children showed marked decreases in minimal engagement and increases in high engagement and full Independence at the end of the intervention study. Statistical results showed a positive correlation with the duration of the intervention in improving daily living skills. Thus, these findings offer concrete evidence in favor of the efficacy of cartoons as an attractive and effective mode of instruction in early intervention and special education settings. Through visual learning firmly embedded in structured behavioural techniques, the cartoon will facilitate the drive toward achieving independent functioning by children with developmental difficulties.

Keywords: Computer animation-based learning; Daily living skills; Special needs education; Brushing and bathing skills; Autism; Intellectual disability; Self-help skills; Early intervention; Kendall’s tau-b; Visual instruction; Shaping and chaining techniques.

Introduction:

"The digital revolution is currently causing a massive transformation in the world of education" (Collins & Halverson, 2018). Due to this "digital revolution," it is indeed crucial and functional to use advanced technologies that are easily accessible when developing training or education programs. Furthermore, becoming convenient, technology can enhance the quality for intellectually disabled students (Wehmeyer, Palmer, Smith, Davies, & Stock, 2008). It is really unavoidable that innovation will be used in academic achievement; if academic institutions do not make an effort to close the gap, people will eventually fall over.

Special education aids students with diverse range of disabilities such as autism, mentally disabled disorders, neurological disorders, vision impairment, and Psychomotor Retardation disease. As per

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estimative methods, over 4.5 million disabled students enroll in schools at an international level, and a considerable number of these students in question possess particular learning difficulties, language or communication difficulties. Special needs children can greatly benefit from educational innovations by helping them to keep up with peers and be better prepared for the future.
Conventional teaching methods verbal instruction, live demonstration, or pictorial representation are often inadequate for this population, as they lack the clarity, repetition, and sensory appeal needed for mastery. In contrast, computer animation can present tasks sequentially with visual reinforcement, auditory cues, and interactive elements. For example, an animated brushing sequence can break down the activity into micro-steps: holding the toothbrush, applying
paste, brushing each surface of the teeth, and rinsing. The multisensory approach strengthens memory, improves imitation, and reduces dependence on caregiver prompting.

Research supports the use of animated interventions in educational and therapeutic contexts, showing improvements in attention span, memory retention, and motivation. When integrated with structured frameworks like the VSMS, Computer animation becomes not only a teaching aid but also a measurable intervention tool. By providing children with accessible, repeatable, and non- judgmental instruction, Computer animation creates inclusive learning environments tailored to diverse cognitive needs. More importantly, it helps the child to develop independence in daily routines, which improves quality of life, reduces caregiver burden, and supports better participation in family, school, and community settings.

Review of Literature:

Computer animation has emerged as a versatile and powerful medium in the domain of health education, life skills training, and behavioural development, particularly for young children and those with special needs. Unlike static teaching tools, Computer animation employs dynamic visuals, motion, colour, and sound to simplify abstract concepts and demonstrate stepwise processes in an engaging and memorable manner. A considerable body of research has highlighted the role of Computer animation as a pedagogical tool for children with special needs, particularly in the domains of cognitive, social, and functional skill development. The findings consistently demonstrate that Computer animation is not just an entertaining medium, but also a structured educational strategy that can promote independence, attention, and learning outcomes.

The application of Computer animation to improve visual–spatial skills among children with cognitive disabilities (Patel and Desai, 2022). Their findings suggested that animated content, with its ability to dynamically depict movement and spatial relationships, provided an engaging platform for learners to practise and refine these abilities skills that are otherwise difficult to teach using static methods. The use of computer animation strengthens conceptual understanding in programming education (Urquiza-Fuentes & Velázquez-Iturbide, 2012). Their study revealed that visual demonstrations, by illustrating complex and abstract concepts dynamically, offered learners a clearer and more intuitive understanding of topics that are otherwise difficult to comprehend through traditional static teaching methods.

The use of animated educational resources support learning among children with Attention Deficit Hyperactivity Disorder (ADHD) (Nguyen & Le, 2021). Their study indicated that computer-based animations significantly improved attention span and enhanced long-term retention of concepts. The visually rich and structured format helped maintain sustained engagement, addressing a common challenge observed in children with ADHD. Similarly, the application of animation for emotional-behavioural development (Mills & Stanton, 2018) showed that animated videos centred on emotional recognition strengthened children's ability to regulate behaviour by effectively linking visual stimuli with corresponding emotional responses.

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Computer animation can be used for teaching social skills such as greetings, turn-taking, and empathy to children with intellectual disabilities (Garcia & Ortega, 2018). The usage of animated modules provided relatable scenarios and role-modelling opportunities, enabling learners to acquire and generalise social behaviours more effectively than conventional approaches. The usage of animated characters facilitates communication in nonverbal children with Autism Spectrum Disorder (Yadav & Srivastava, 2019). Their results showed notable improvements in receptive and expressive communication, suggesting that Computer animation can bridge abstract language concepts with tangible visual cues.

The role of animated social tales was used for children with ASD and found significant gains in recognising social cues and responding appropriately in real- life situations. Unlike traditional static stories, animated versions offered interactive and visually rich narratives, which enhanced comprehension and recall (Hong and Lee, 2021). (Djafarova, 2022)conducted a comparative study of three technology-based mediums: animated video scenarios, game movies, and serious games. The results showed that all formats significantly boosted learner motivation and performance, but animated videos were more accessible to younger learners and those with cognitive challenges, due to their simplicity and clarity. (Yusop et al., 2024) discussed the development of a prototyping-based Child–Individualized Instructional Programmed (CIIP) for children with ASD. By including iterative multimedia design elements such as Computer animation, the program provided tailored learning experiences that adapted to each child's pace, preferences, and developmental needs. This highlights how Computer animation can be integrated into personalized educational plans.

These studies strongly suggest that Computer animation is not merely a supplementary tool, but a structured educational and therapeutic medium. Evidence indicates that it enhances attention, supports memory retention, improves communication, and facilitates the development of both cognitive and social skills. Most importantly, Computer animation provides a flexible approach that can be adapted to a child's developmental stage and learning style, making it a highly promising intervention for kids with special needs.

Methodology:

This study aimed to assess the efficacy of Computer animation in instructing special needs kids in fundamental self-care activities, including brushing and bathing. The study, conducted in child guidance clinics in Mangalore city, focused on therapeutic early intervention for children aged three to six years. Total of thirty participants comprising an equal number of boys and girls were selected using a purposive sample technique, with fifteen individuals from each gender. The criteria encompassed special needs children aged three to six years who obtained consent from their primary caregivers to participate. Children residing in institutional settings, specifically those under three years of age or beyond six years of age, along with those with associated physical problems, were barred from admission. The study underscored the importance of ethical compliance and informed consent to ensure voluntary and confidential participation.

Three primary data collection instruments were used by the researcher. A personal data sheet was generated to collect demographic and diagnostic information from participants. A five-point grading system was established to accurately assess the children's levels of involvement and proficiency in brushing and bathing, with scores ranging from minimal engagement/very poor (1 point) to full independence/very good (5 point). The intervention primarily used a combination of chaining and shaping methods created by researcher. Kids who see the in-depth computer animated content on brushing and bathing will certainly see, copy, and eventually come to be proficient in each step. The video utilized visual cues and favorable reinforcement approaches, such as praise, to motivate involvement and continuous learning. This organized, Computer animation-based guidance aims to

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improve the functional skill development and Independence of children with unique demands.

Procedure

The intervention lasted for 6 months, split into 2 phases, each lasting three months. One part focused on bathing skills, while the other focused on brushing skills. There were a total of 14 sessions in each phase, which were planned and customized to help children with special requirements discover these abilities properly. The program adhered to an organized approach that included evaluations at the beginning, making use of videos to show, keeping an eye on progress weekly, and examining enhancement gradually.

In the very first month of the bathing stage, baseline information was accumulated utilizing a personal data sheet to record the child's demographic details, medical diagnosis, period of therapy, and current level of showering ability. The degree of practical freedom in showering was determined using a five-point score scale created by the scientist, which classified performance right into five levels-- varying from minimal engagement (rating 1) to full Independence (score 5). In the second session, the computer-animated training video on showering was introduced to the key caregiver. The researcher gave a comprehensive description of the daily use of the video throughout the kids' showering routine and clarified the principles of shaping and chaining ingrained in the video web content. Following this, caregivers were given an entrance sheet to log their everyday use of computer animation, taping the youngster's engagement and progress with the video-based job. The researcher conducted regular follow-up sessions with each caregiver-child set, assessing the child's involvement utilizing the five-point ranking scale. This cycle continued for a full 3 months, permitting constant monitoring and information collection to determine ability development gradually.

The brushing phase mirrored the framework and period of what came before. After completing the bathing intervention, the next three-month cycle concentrated on involving computer-animated video clip web content. At the outset of this stage, the researcher reevaluated the child's preliminary brushing effectiveness utilizing the exact same standard analysis tool to preserve uniformity. The animated video clip, crafted using reliable instructional techniques such as steady skill-building, consecutive learning, and encouragement, was then offered to caretakers, who were advised on how to incorporate it into the child's daily brushing regimen. The monitoring sheet records the day-to-day progression. Throughout the three months, the researcher conducted regular evaluations and observations once a week, using the standardized scale to record the youngster's innovation.

Before the research study occurred, the official ethical clearance authorization was obtained from the clearance board, where the researcher made clear all the inquiries raised by the board. The ethical consideration of research fulfilled by rundown that the research study and ensuring discretion regarding information to all individuals. The process of obtaining informed permission starts by describing to the participants concerning general objective of the assessment, including the reason she/he being asked to complete the examination being use in the study. Enlightened permission indicates that respondents have consented to complete the evaluation without being forced to do so, and recognized what the job entails and how the outcomes will be utilized.

Throughout the six-month research study, participation was purely volunteer, with educated consent obtained from all caretakers prior to data collection. Moral standards were rigorously promoted and confidentiality was maintained; the purpose and use of the study were plainly described. The caregivers who met the incorporation standards institutional personnel and caregivers played a major role in the successful implementation of the treatment. At the conclusion of both treatment stages, all collected information was put together and statistically evaluated to determine the performance of computer-animated web content in improving bathing and cleaning abilities in youngsters with special needs.

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Statistical Analysis

Statistical analysis entails employing techniques to methodically arrange, interpret, and derive significant conclusions from gathered data. The study aims to evaluate the efficacy of computer animation-based interventions in enhancing daily living skills, specifically brushing and bathing, in children with special needs over a three-month duration. Weekly assessments of the children's engagement levels were conducted using a five-point rating scale devised by the researcher, recording notable progress in self-help activities.

Due to the longitudinal measurements acquired and the ordinal characteristics of the data, Kendall's tau-b correlation was the principal statistical method employed in the study. Kendall's tau-b is a non-parametric statistical method employed to ascertain the strength and direction of the relationship between two ranked variables, specifically the duration of time (weekly sessions over three months) and variations in engagement or skill levels. The method was suitable for the study as it does not presume normal distribution, functions efficiently with smaller sample sizes, and is optimal for assessing trends in ordinal data. The study aimed to determine whether the duration of the intervention was linked to improvements in children's hygiene practices. Statistical significance was defined by a p-value of 0.05 or less, indicating that observed trends in engagement were unlikely due to chance.

Statistical analyses were conducted using SPSS (Statistical Package for the Social Sciences), a prevalent software application in educational and psychological research. Microsoft Excel was utilized to organize raw data, compute essential descriptive statistics, and generate tables and visual representations that depicted performance trends during the three-month intervention period. This comprehensive approach facilitated an accurate assessment of the animated content's efficacy in promoting functional Independence in children with special needs.

Result & Discussion:

Bathing and brushing abilities are important components of the daily hygiene regimen, and the need for support in children with special needs, diagnosed with Intellectual Disability and Autism, may shed light on their developmental progress regarding such functions. Bathing and brushing abilities are activities of daily living, which directly support the enhancement of personal hygiene and are directly related to promoting Independence and self-care skills in activities of daily living. Participation and performance patterns of children with Intellectual Disabilities and Autism in bathing and brushing activities over a period of three months on a day-to-day basis are described before presenting an analysis of the differences between days and between the different diagnostic categories. Thus, it is through this exploration that the study wishes to offer that insight which has, as yet, been undiscovered, on how customized interventions may promote the quality of life and functional Independence of children with disabilities.

BATHING SKILLSET

To assess how children's bathing skills developed during three-month computer animation-based intervention, engagement levels were categorized into five stages: Minimal Engagement, Partial Engagement, Moderate Engagement, High Engagement, and Full Independence. The distribution of participants across these levels was recorded each month to observe changes in performance and functional Independence. The data in Table 1 displays the distribution and progress percentage for each month, with the total count.

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Table 1 Distribution and Progression Percentage by Month and Total Count

Month	Minimal Engagement	% Minimal Engagement	Partial Engagement	% Partial Engagement	Moderate Engagement	% Moderate Engagement	High Engagement	% High Engagement	Full Independence	% Full Independence
Month 1	59	49.20%	40	33.30%	21	17.50%	0	0.00%	0	0.00%
Month 2	26	21.70%	49	40.80%	33	27.50%	11	9.20%	1	0.80%
Month 3	5	4.20%	40	33.30%	44	36.70%	27	22.50%	4	3.30%
Total	90	25.00%	129	35.80%	98	27.20%	38	10.60%	5	1.40%

An examination of bathing skill growth over three months shows a distinct change from low participation to more elevated levels of freedom in the learners.
During Month 1, most kids fell into the Minimal Engagement category (59 out of total entries; 49.2% of the observations). There were another 40 children with Partial Engagement (33.3%) and 21 children at Moderate Engagement (17.5%). No children attained High Engagement or Full Independence in this period.

By the second month, there was great progress noted. The count of kids at the Minimal Engagement level fell to 26 (21.7%), and Partial Engagement rose to 49 (40.8%), showing that more kids were involved fairly well with some help. The Moderate Engagement group increased to 33 (27.5%), while 11 kids (9.2%) attained High Engagement, and 1 child (0.8%) achieved Full Independence in bathing.

The Month 3 progression became even more evident. Only 5 children (4.2%) were left in the Minimal Engagement category. It was steady that Partial Engagement 40 (33.3%) children, but the count for Moderate Engagement rose to 44 (36.7%). In addition, 27 children (22.5%) who achieved High Engagement were noted and 4 children (3.3%) who had reached Full Independence in bathing. This trend provided a very clear numeric and percent picture of the influence of the Computer animation-based intervention across time.

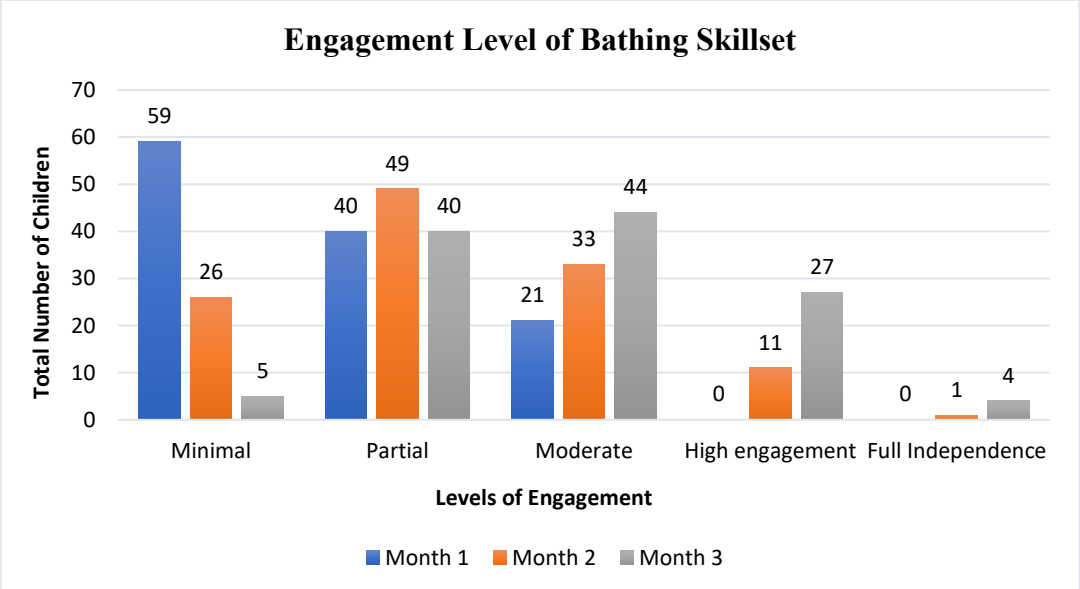

Figure 1 Tracking Engagement Levels: A Three-Month Overview

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The figure.1 provides an overview of engagement levels across three months. Majority of the children (59) in Month 1 were in the Minimal Engagement category, meaning great reliance during bathing rituals. Similarly, a clear drop can be seen in minimal involvement, as this number gradually dropped to 26 in Month 2 and then to only 5 in Month 3. On the other hand, Moderate Engagement progressed greatly from 21 in Month 1 to 44 in Month 3. Over all months, the number of children showing partial engagement stayed constant between 40 and 49.

The most notable level of engagement is seen in the categories of High Engagement and Full Independence. Not a single child attained these standards in Month 1. By month 2, 11 children reached High Engagement, and one reached Full Independence. By the end of Month 3, 27 children fell into the High Engagement category and 4 attained Full Independence; this considerable improvement in bathing skill independence may be directly ascribed to the Computer animation-based intervention.

Kendall's tau-b analysis

Kendall's tau-b correlation was utilized to evaluate how time (Month 1 to Month 3) and the level of engagement in order to validate the progression in bathing skills statistically. This method is ideal for ordinal data and determines the direction and strength of the association between variables.

Table 2 Correlation between Kendall's tau-b and statistical measures

Kendall's tau-b	Std. Error	T-value	p-value
.426	.036	11.590	<0001vhs

The results of the symmetric measures analysis using Kendall's tau-b are indicated in the table. Figure 2 shows a strong positive relationship between the ordinal variables. The Kendall's tau-b value is 0.426, suggesting a moderate to strong correlation. The asymptotic standard error is 0.036, which reflects the precision of the correlation estimate. The strength of the observed correlation is significantly high, with the approximate t- t-value of 11.590. The correlation is statistically highly significant, with a p-value less than 0.001 indicating that the observed relationship is unlikely to have occurred by chance. This strong correlation implies a meaningful and reliable association between the ordinal variables.

BRUSHING SKILLSET

The brushing skillset was similarly monitored through five levels: Very Poor, Poor, Acceptable, Good, and Very Good. Children's brushing performance was evaluated monthly to track improvements as a result of the computer animation based instructional intervention. The results in Table 3 demonstrate the evolution and improvement of brushing abilities assisted by the computer animation content.

Table 3 Progress of Brushing Skills Using Computer animation Content

Month	Very Poor Count	% Very Poor	Poor Count	% Poor	Acceptable Count	% Acceptable	Good Count	% Good	Very Good Count	% Very Good
Month 1	33	27.50%	37	30.80%	39	32.50%	11	9.20%	0	0.00%
Month 2	10	8.30%	23	19.20%	41	34.20%	42	35.00%	4	3.30%
Month 3	4	3.30%	14	11.70%	29	24.20%	41	34.20%	32	26.70%
Total	47	13.10%	74	20.60%	109	30.30%	94	26.10%	36	10.00%

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The brushing skill data also reflects a marked improvement in children's Independence across the three months.

In Month 1, 33 children (27.5%) were rated as Very Poor, and 37 children (30.8%) were in the Poor category. 39 children (32.5%) demonstrated an Acceptable level of brushing skill, while only 11 children (9.2%) were rated as Good, and none (0%) were classified under Very Good performance.

By Month 2, the number of Very Poor cases dropped significantly to 10 children (8.3%), and Poor ratings reduced to 23 children (19.2%). The number of children with Acceptable brushing skills increased to 41 (34.2%), while those in the Good category rose substantially to 42 (35.0%). Importantly, 4 children (3.3%) had now progressed to the Very Good level.

In Month 3, the data continued to show growth in performance. Only 4 children (3.3%) were still in the Very Poor category, and 14 (11.7%) were in the Poor group. The number of children rated as Acceptable decreased to 29 (24.2%), but this was offset by continued growth in the higher categories. 41 children (34.2%) achieved a Good rating, and 32 children (26.7%) were now performing at the Very Good level. This consistent increase in Good and Very Good ratings confirms the effectiveness of the Computer animation intervention in helping children independently perform brushing routines.

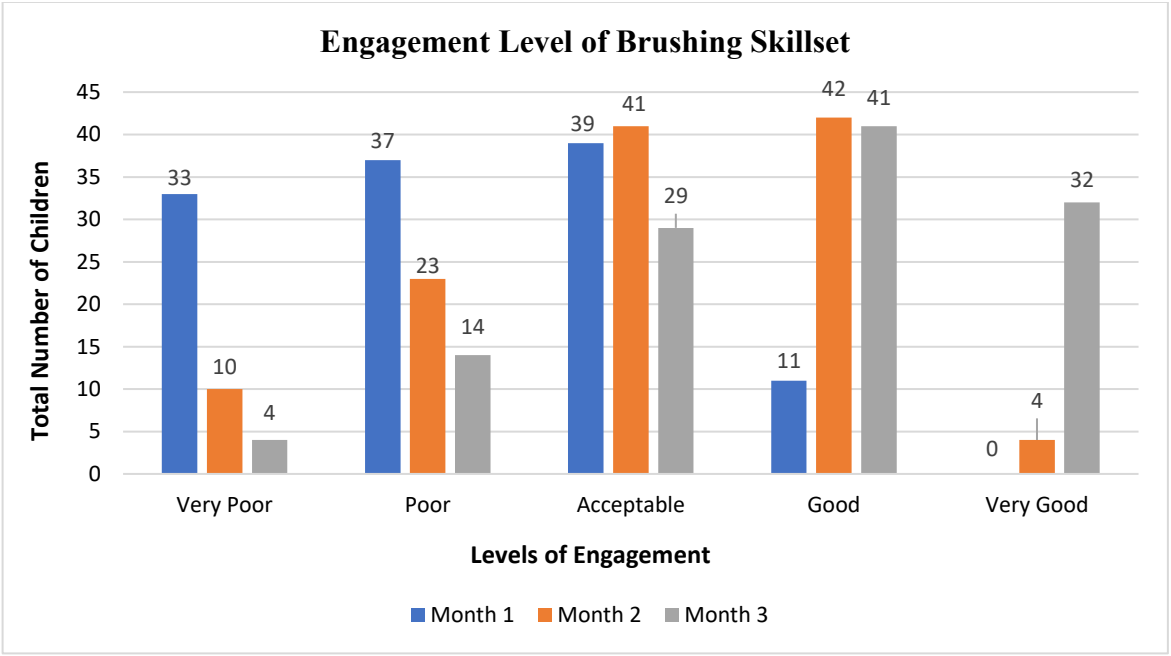

Figure 2 Monitoring Engagement Levels: A 3-Month Analysis of Ratings

The figure 2 demonstrates how children progressed across five brushing performance categories—Very Poor, Poor, Acceptable, Good, and Very Good—during the three-month intervention period.

Initially, in Month 1, 33 children were rated Very Poor and 37 as Poor, together forming the largest group. Over time, these numbers decreased dramatically, with Very Poor reducing to 10 in Month 2 and only 4 in Month 3. Similarly, Poor performance dropped from 37 in Month 1 to 14 in Month 3. This clearly reflects a substantial reduction in low skill levels. At the same time, children showing Good and Very Good performance levels increased significantly. In Month 1, only 11 children achieved a Good level and none were Very Good. By Month 2, the Good category jumped to 42, and 4 children reached the Very Good level. In Month 3, 41 children maintained Good performance and 32 reached Very Good, marking a substantial shift in brushing independence. These improvements,

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visually represented in the chart, provide strong evidence of the effectiveness of the Computer animation intervention in enhancing brushing skills among children with special needs.

Kendall's tau-b analysis

In Table 4, the correlation between Kendall's tau-b and p-value is displayed, offering insights into the degree of connection between two variables and the probability of achieving comparable outcomes by coincidence.

Table 4 Correlation between Kendall's tau-b and statistical measures

Kendall's tau-b	Std. Error	T-value	p-value
.438	.036	11.768	.000

The Kendall's tau-b coefficient of 0.438, with a standard error of 0.036, indicates a strong positive correlation between the ordinal variables being measured. The t-value of 11.768 further supports the strength of this relationship. With a p-value of 0.000, which is well below the conventional significance threshold of 0.05, this correlation is statistically significant. This suggests a robust and meaningful association between the variables, reflecting that as one variable increases, the other tends to increase as well, with high confidence in the reliability of this finding.

Conclusion

This study aims to understand the effectiveness of Computer animation content in teaching self-help skills for special needs kids aged 3 to 6 years, like brushing and bathing. Across three months, the intervention used animated videos created utilizing the shaping and chaining techniques, and tracking the development regularly using a five-point rating scale. The visual data presentation, as well as statistical analysis findings, show striking proof of the success of the intervention.

Results indicated a steady growth with active and passive participation by the individuals involved in the activities. As time passed, the number of children performing at the minimum and very poorly levels depleted significantly; conversely, those showing great participation and complete Independence increased rather briskly. Statistically significant correlations, which agreed with Kendall's tau-b, showed a positive relationship between time and the development of the skill, further confirming this trend.

Results show the effective use of Computer animation as a teaching aid in special education, especially for the imparting of life skills. The visual and ordered nature of Computer animation helps children whose development is atypical meet their learning needs, so that simplifying and repeatable versions of complex routines become more achievable. Early intervention programs empower teachers and therapists to integrate technology into their activities to elicit engagement, better learning results, and more autonomy for special needs kids. This study supports the use of computer animated instructional content as a useful, easily available, and effective approach to developing fundamental self-care skills. Therefore, it supports the long-term objective of instilling children with special needs to greater autonomy and quality of life.

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