International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 3
DOI: https://doi.org/10.17762/ijritcc.v11i3.6336
***Article Received**: 18 December 2022 **Revised**: 26 January 2023 **Accepted**: 10 February 2023*

Children's Perspective on Digital Picure Book: A Brief Analysis

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Abstract: Early exposure to symbolic media, such as pictures, drawings, paintings, photos, and videos, is common in western countries. Modern picture books coexist with electronic storybooks and other digital literature, expanding the environment in which young children develop and learn. Since the advent of new technologies, recommendations for kids' use of these gadgets have been covered in numerous papers. Young children and adults can engage in social interaction through picture books, which creates a wonderful chance for learning and teaching. This paper makes an analysis on children's digital story book reading behavior. Initially, the features (considered questions) are clustered using k means clustering model. In order to analyze the children's digital story book reading behavior, the questions are made on different drivers such as (i) Characteristics of story book, (ii) Interaction level and (iii) Child learning ability level. The questions are analyzed based upon the responses obtained from 100 respondents with 46 males and 54 females. Here, the study is done using ANOVA, regression analysis along with MSE, correlation and variance computation. Based upon the clustering outputs, the regression analysis is made on correlation and covariance metrics.

Keywords: Digital storybook; Interaction; Reading behavior; Child learning; ANOVA analysis.

I. INTRODUCTION

The digital revolution and the continued popularity of digital reading devices have had an influence on the creation, distribution, and characteristics of modern narrative picture books. Digitally created texts may share certain fundamental characteristics with their print-based predecessors, but picture book applications offer access to further features, material, and forms of interaction that print-based texts might not [8] [9] [10] support. Picture book apps are frequently thought of as upgraded versions of picture books that are printed on paper since they provide extra information, features, and navigational possibilities not seen in printed texts. To improve the children's experience, instructors, parents, and reader must take into account both the advantages and disadvantages of adopting print-based and digital texts [11] [12] [13].

Digital picture book readers must use a variety of methods and talents, including cognitive, physical, visual, emotive, and embodied ones, to navigate the representation of a fictional story [14] [15]. Picture book researchers, classroom teachers and learning educators will require new lenses or frameworks for analysing these texts and creating pedagogical strategies that support classroom training and readers' exchanges across digital and print based channels as picture book stories in digital formats develop and become a part of the reading syllabus in more classrooms [16] [17] [18].

Picture book applications are made to be used with certain digital or web-based platforms, reading devices, tablets, and smart phones [19] [20] [21]. Scanned reproductions of the original print based picture books are only digital renditions of the book with the same design as the original, only seen on a screen as opposed to in print based or analogue forms, offering the barest minimum of interactivity. Picture book applications differ from standard e-books in a few important areas that significantly change the reading experience [22] [23] [24] [25].

Here, Section II reviews the extant works on child story book reading behaviour. Section III describes the problem statement. Section IV depicts overall depiction on proposed analysis. Section V delineates outlook on child story book reading behaviour and section VI describes the analytical results. Section VII concludes the work.

II. LITERATURE REVIEW

A. Related Works

The benefits of an organized story telling strategy on the growth of young children's reading and digital literacy abilities were examined in a study presented by Maureen et al. [1] in 2020. 62 kids between the ages of 5 and 6 took part in an experimental study that involved three classrooms in two public kindergartens. One of 3 experimental conditions was chosen for each classroom. The students in one classroom went through their typical literacy exercises. While kids participated in digital storytelling and activity in the third classroom, the

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second classroom promoted literacy development through storytelling and related play-based activities. Assessments of digital and early literacy abilities were used to evaluate outcomes both prior to and after 6-week program. The results demonstrated that children's reading and digital literacy abilities were greatly improved under both storytelling situations. Structured story telling actions provided a valuable and viable manner to improve digital literacy in earlier child education.

This issue is posed to the book community in a novel three-year initiative that was launched in 2007 by Matthew et al. [2] and is located in the United Kingdom. Publishers, authors, and illustrators are intended to be made aware of the lack of representation of handicapped persons in children's media through the disability charity in the picture. The goal of the initiative is to make sure that impaired children may be seen in children's books and other media. Here, we'll outline the purpose of the project and its objectives. We will continue to recommend what this type of proposal can instruct those of us who work in initial years settings regarding assisting equality and inclusion via children's media and literature based on a primary assessment of the project's effect that incorporated discussions and focus groups discussions with scholars, teachers, parents, and children.

In 2019, Raynaudo et al. [3] evaluated how two alternative picture-book styles affected kids' understanding of the idea of camouflage. The learning methods for forty-four-year-olds were either using a printed book or an electronic book. The book's instruction and substance were combined. We examined the learning, transfer, and reasoning of the kids in a quasi-experimental pre-test-post-test approach. As a result of the test phases, the accurate replies greatly rose, with no variations across circumstances, according to the results. Children also applied the idea to both types of visuals. Children gave more concealment arguments following the reading than they had previously.

Employing a children's story creation system for children's creativity enhancement was explored by Kim et al. in 2018 [4]. The only available early childhood education materials have fixed 2D picture elements. Children may directly participate by creating a 3D moving image of a certain character kind as one item and utilising a 3D simulation that is simple to display on the screen. It offers several editing options, including size and 3D deformation operation. Through the features, kids may communicate their thoughts. The 3D modelling simulator is the final component of the thesis's fundamental development technique. We use the data information generated by the 3D modelling data to apply the 3D modelling data to the story book template components for this purpose. A 3D modelling data simulator and execution method has been created as a consequence of a way of entering data check sheet information for every character.

Imşek et al.'s study [5] in 2021 examined the impact of digital, dialogic, and conventional reading on 48–66-month-old child language development. In the study, 56 randomly chosen kids from three separate classrooms in a Turkish public preschool took part. Once more, the 3 classrooms were divided into groups for digital, dialogic, and conventional reading. Each group read three storybooks every week for eight weeks as part of the reading exercises, for a total of 24 storybooks. While the child language ratings (the expressive and receptive scores) led to a considerable improvement in interactional reading, the child language scores in a traditional and digital analysis group changed just minimally at the time of intervention.

With 25 preschoolers, ages 4-5, Zipke et al. [6] examined the impact of reading digital story books on tablet devices in 2017. In the first trial, it was discovered that using the read-aloud feature and interacting with a digital storybook dramatically increased students' word recognition scores compared to having a comparable print book read to them. In the two scenarios, their comprehension ratings did not significantly differ. The similar students investigated digital storybooks with greater animation included in Experiment 2. In both situations, the kids used the tablet computer's read-aloud feature and explored digital storybooks, but in one, a teacher facilitated the discussion of the selected narrative. Contrary to predictions, the students performed better in the autonomous condition than in the supervised condition in terms of word identification and story comprehension.

In 2016, Zhang et al. [7] looked at how the portrayal of the book on the TV show changed the meaning when semiotic resources like animation, music, and camera movement were used. We contend that the use of such materials may gradually alter the meanings communicated by the original picture book's language and visuals, which may have an impact on how young viewers respond to the story. Examining how these resources are used in the picture book's TV depiction is thus a crucial initial step in creating research works for assessing how well children's literacy is supported by television programmes that include picture book reading.

Altun et al. [8] in 2018 saw a thorough investigation on the narrative comprehension abilities of preliterate preschoolers. The chief aim of this learning is to determine if the added multimedia components of digital storybooks help or hurt young children's explicit and implicit understanding during a minor group reading exercise. The results showed that (a) children with in media storybook group performed better than children in the print story book group regarding direct and indirect story comprehension, (b) for both groups, explicit story comprehension was greater than implicit story comprehension, and (c) the children remembered substantially greater extent of

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story essentials and the story retelling's length with the help of animated demonstrations.

III. PROBLEM STATEMENT

A. Research Gaps

With the increasing improvement of people's living standards in China, people pay more and more attention to the richness and pleasure of the spiritual world. For example, the elderly like singing and dancing, young people like travelling and watching movies, while children like playing games and doing handicrafts. Children's picture books are also an important partner for children to enrich their spiritual world. At present, most children's picture books in circulation are mainly imported from foreign countries. Although China's excellent original picture books are also increasing, there are still relatively few excellent original picture books with traditional cultural context and Chinese characteristics. There are still many problems in children's picture books in China, mainly in the following aspects:

1) Painting design is similar, with a single interaction way, and a lack of national characteristics: Compared with the past decade, China's original picture books have been greatly improved in terms of story content, graphic design, painting style and printing technology. However, the hot picture book children's book market has bred a lot of acne. There are a lot of pirated books. Some picture books directly imitate some foreign high-quality picture books, such as the similarity of story content; painting form and layout design, and lose their own characteristics. Fig.1 shows the sample child storybook model.

Figure 1: Sample Child Storybook model

2) Parents have limited ability to guide reading: Many parents and teachers lack scientific methods when guiding children to read. Due to the difference of cultural level, some parents don't even choose picture books reasonably, just want to teach children knowledge through picture books, and ignore the law of children's psychological development. In the minds of some parents, knowledge has become the main, while establishing children's interest in picture books, learning the positive spirit in picture book stories, honest character and so on has become the secondary. Fig. 2 illustrates the sample storybook cover page design.

Figure 2: Storybook cover page design

3) Teachers have limited ability to guide reading: In the campus, when guiding reading, many teachers face the rich pictures and simple and easy to understand story content of picture books, but they don't know how to spread their thinking and expand their thinking. They can't make full use of picture books. They can only read the text according to the book or learn in advance. Fig. 3 depicts the sample digital storybook.

Figure 3: Sample Digital storybook

4) Research Background : According to quest mobile data there are about 100 million children aged 0-6 in China. The huge base and the favourable two-child policy have laid a solid customer foundation for the early childhood education market, and there is great room for development in the future. The demand for children's picture books is also in short supply. Children's picture books not only delight and meet children's spiritual world, but also carry the role of education. Parents are children's first teachers, and good education comes from family education. Parent-child reading can not only promote parent-child relationship, but also bring children a full sense of security. In the process of reading, not only parents take their children to see, but also communication and communication, input and output. In this process, children's language ability is effectively cultivated. It can also make children love reading and learning. In the process of parent-child reading, children's outlook on life, values, creativity, sense of responsibility, enterprising spirit and so on are unconsciously cultivated.

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At present, there are many kinds of children's picture books, from a single plane book in the past to a 3D three-dimensional book, smell book, hand puppet book, cave book and so on. Different forms of books not only bring children a rich sense of experience, but also bring designers new challenges. Designers must find new breakthrough points to improve children's sense of experience, attract children's attention and expand children's thinking ability. Han Wenli mentioned that in the content part of the integration of picture book learning and practice, the mode of teaching in fun can be considered to make the learning content of picture book more intuitive, the learning method more interesting and the learning effect more remarkable.

IV. OVERALL DEPICTION ON PROPOSED ANALYSIS

A. Prepared Questionnaire

The constructed questionnaire is comprised of 18 questions and is categorized as Characteristics of story book, Interaction level and Child Learning ability level. Characteristics of story book contain 5 questions, Interaction level includes 4 questions, and Child Learning ability level contains 9 questions. Fig. 4 illustrates representation of indicators adopted for this work and consequent questions are shown in Table I, II and Table III.

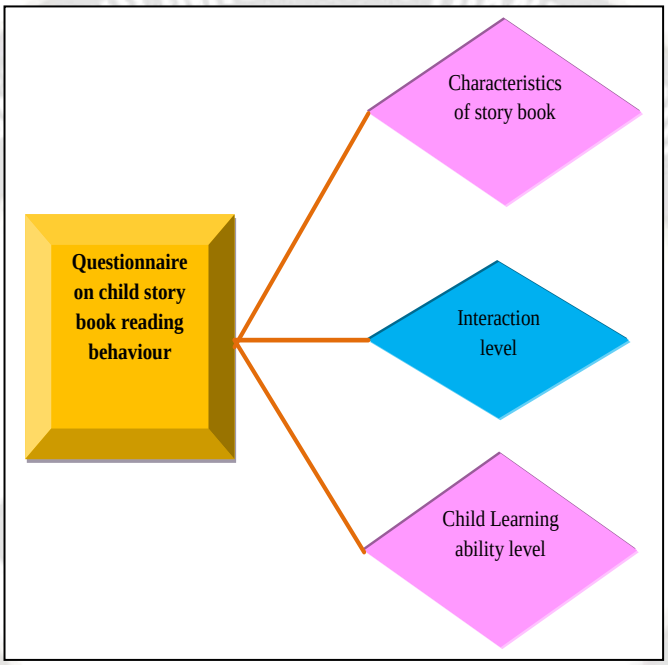

Figure 4: Representation of designed questionnaire

TABLE I: QUESTIONNAIRE ON CHARACTERISTICS OF STORY BOOK

1.	Are you enjoying this (design/ model) of digital storybook?
2	Do the images, text, video and audio that used in the storybook are exciting?
3	Do they are usage friendly?
4	Is it have interested read-aloud feature?
5	Are you have any thinking on using this digital storybook?

TABLE II: QUESTIONNAIRE ON INTERACTION LEVEL

1.	More effectual one regarding story recall
2	More effectual one regarding word identification
3	Regarding exploration of interactive storybook app's read aloud function, which is more effectual (a) word recognition and story comprehension (b) taking a teacher guide using the app
4	Multimedia e-book with minute digital interactivity, superior (a) in supporting literacy accomplishment of pre-readers (b) in supporting an e-book with added digital interactivity

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TABLE III: QUESTIONNAIRE ON CHILD LEARNING ABILITY LEVEL

1.	Real Stories and one with more visions on them
2	Theme re**cognize** with per**sonalities** and aid them deal with new problems or situations
3	Characters not generally fully developed.
4	Situation deployed for establishing story location in place and time, clarify historical background or create a mood.
5	Children who entangled in act, recognize issue, and unravel it quickly.
6	Need Enhancement of the story of the digital print book
7	Often a rhythmic style of writing in the digital print book
8	Surprise and the Unexpected
9	Children simply recognize with the actions and emotions of characters

B. Data Collection Procedure

The data was collected from a total of 100 people from Wuhan City of China. Among 100 people, 46 people were male and 54 people were female. The respondents correctly respond to the surveys based on their views on child story book reading behaviour. To find the story book reading behaviour, the obtained responses are then subjected to analysis.

Initially, the features (considered questions) are clustered using k means clustering model. Based upon the clustering outputs, the regression analysis is made on correlation and covariance metrics.

C. K-means clustering

An unsupervised learning technique called K-means [29] is used to separate the focus area from the background. It is the most popular clustering model, and K stands for the number of clusters. The following illustrates how the K-means model operates:

Step 1: First, pre-defined cluster counts are used (i.e. K-value)

Step 2: Data points are assigned at random to each cluster.

Step 3: The cluster centres are computed after that.

Step 4: The distance between each cluster and each data point is calculated.

Step 5: Based on their separation from the cluster, reassign the data points to the clusters that are closest to them.

Step 6: A second calculation is made for the new cluster centre.

Step 7: The 4-6 steps are repetitive if no data points vary its clusters.

V. OUTLOOK ON CHILD STORY BOOK READING BEHAVIOUR

A. Characteristics of story book

The indicator Characteristics of story book is made with 5 questions. The questions include "1. Are you enjoying this (design/ model) of digital storybook?, 2. Do the images, text, video and audio that used in the storybook are exciting? 3. Do they are usage friendly? 4. Is it have interested read-aloud feature? 5. Are you have any thinking on using this digital storybook?. The analysis on above said questions is done with respect to mean, standard deviation, correlation, variance and MSE, adjusted R Square and R Square and described in results section.

B. Interaction level

The indicator Interaction level is made with 4 questions. The questions include "1. Which is more effective, in terms of story recall ? (a) listening to and exploring the read aloud function of an interactive storybook app or (b) listening to a teacher read from a traditional storybook, 2. Which is more effective, in terms of word recognition? (a) Listening to and exploring the read aloud function of an interactive storybook app or (b) listening to a teacher read from a traditional storybook, 3. Is exploring the read aloud function of an interactive storybook app independently is more effective in terms of (a) story comprehension and word recognition or (b) having a teacher guide students through the app. 4. Is a book-like e-book, with multimedia but little digital interactivity, superior in supporting (a) supporting pre-readers' literacy achievement or (b) an e-book with more digital interactivity". The analysis on these questions is done regarding mean, standard deviation, correlation, variance and MSE, adjusted R Square and R Square and described in results section.

C. Child Learning ability level

The indicator Child Learning ability level is made with 9 questions. The questions include "1. Real Stories and one with more visions on them, 2. Theme recognize with personalities and aid them deal with new problems or situations, 3. Characters not generally fully developed, 4. Situation deployed for establishing story location in place and time, clarify historical background or create a mood, 5. Children who entangled in act, recognize issue, and unravel it quickly, 6. Need Enhancement of the story of the digital print book, 7. Often a rhythmic style of writing in the digital print book, 8. Surprise and the Unexpected and (9) Children simply recognize

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with the actions and emotions of characters". The analysis on above mentioned 9 questions is done regarding mean, standard deviation, correlation, variance and MSE, adjusted R Square and R Square and described in results section.

VI. Analytical Results

A. Simulation procedure

MATLAB was used to assess the implemented analysis after the respondents' responses were entered. The analysis's major focus was on the child story book reading behaviour under 3 constraints: Characteristics of story book, Interaction level and Child Learning ability level. Characteristics of story book contain 5 questions, Interaction level includes 4 questions, and Child Learning ability level contains 9 questions. This analysis used regression, ANOVA and statistical analysis to determine the study of the child story book reading behaviour. The demographic characteristics (46 males and 54 females) were shown in Table IV.

TABLE IV: DEMOGRAPHIC CHARACTERISTICS

Gender	Respondents
Male	46
Female	54

B. Characteristics of story book

The statistical analysis on characteristics of story book level for child story book reading behaviour is shown in Table V. The statement on Are you enjoying this (design/ model) of digital storybook has got a mean and SD of 4.41 and 1.25. The statement on Do the images, text, video and audio that used in the storybook are exciting has got a mean and SD of 4.25 and 1.11. The statement on Do they are usage friendly has got a mean and SD of 4.74 and 1.45. The statement on Is it have interested read-aloud feature has got a mean and SD of 4.80 and 1.87. The statement on Are you have any thinking on using this digital storybook has got a mean and SD of 4.21 and 1.10.

The analysis on correlation, variance and MSE analysis on characteristics of story book level for child story book reading behaviour is shown in Table VI. The analysis on correlation, variance and MSE analysis on characteristics of story book level for child story book reading behaviour is also shown in graphical form in Fig. 5. The statement on Are you enjoying this (design/ model) of digital storybook has got a MSE of 0.4213. The statement on Do the images, text, video and audio that used in the storybook are exciting have got a MSE of 0.4254. The statement on Do they are usage friendly has got a MSE of 0.4217. The statement on Is it have interested read-aloud feature has got a MSE of 0.4554. The statement on Are you have any thinking on using this digital storybook has got MSE of 0.4112.

TABLE V: STATISTICAL ANALYSIS ON CHARACTERISTICS OF STORY BOOK FOR CHILD STORY BOOK READING BEHAVIOUR

Statement	Mean	SD
Are you enjoying this (design/ model) of digital storybook?	4.41	1.25
Do the images, text, video and audio that used in the storybook are exciting?	4.25	1.11
Do they are usage friendly?	4.74	1.45
Is it have interested read-aloud feature?	4.80	1.87
Are you have any thinking on using this digital storybook?	4.21	1.10

TABLE VI: CORRELATION, VARIANCE AND MSE ANALYSIS ON CHARACTERISTICS OF STORY BOOK FOR CHILD STORY BOOK READING BEHAVIOUR

Statement	Correlation	Variance	R square	Adjusted R Square	MSE
Are you enjoying this (design/ model) of digital storybook?	0.422	0.529	0.421	0.433	0.4213
Do the images, text, video and audio that used in the storybook are exciting?	0.429	0.524	0.421	0.496	0.4254
Do they are usage friendly?	0.325	0.523	0.429	0.458	0.4217
Is it have interested read-aloud feature?	0.424	0.541	0.422	0.407	0.4554
Are you have any thinking on using this digital storybook?	0.425	0.539	0.401	0.410	0.4112

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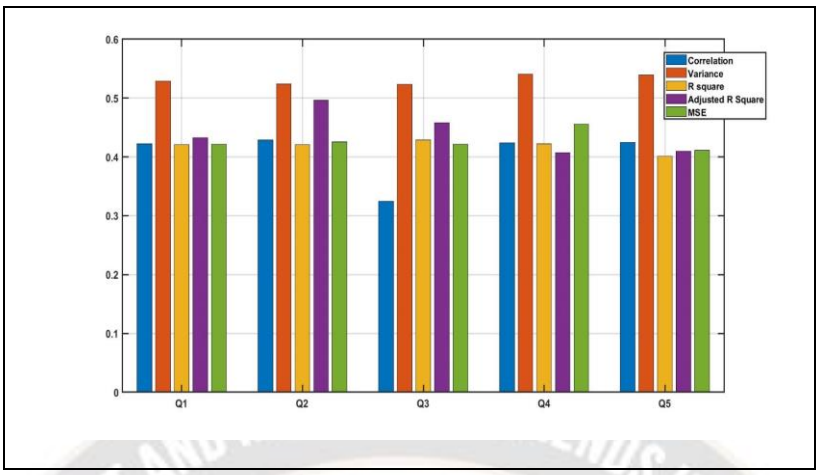

Figure 5: Correlation, variance and MSE analysis on Characteristics of story book for child story book reading behaviour

C. Interaction level

The statistical analysis on interaction level for child story book reading behaviour is shown in Table VII. The statement on More effectual one regarding story recall has got a mean and SD of 4.58 and 1.25. The statement on More effectual one regarding word identification has got a mean and SD of 4.12 and 1.13. The statement on Regarding exploration of interactive storybook app's read aloud function, which is more effectual has got a mean and SD of 4.88 and 1.68. The statement on Multimedia e-book with minute digital interactivity, superior has got a mean and SD of 4.98 and 1.77.

The analysis on correlation, variance and MSE analysis on interaction level for child story book reading behaviour is shown in Table VIII. The examination on correlation, variance and MSE analysis on interaction level is exposed in graphical form in Fig. 6. The statement on More effectual one regarding story recall has got a MSE of 0.4234. The statement on More effectual one regarding word identification have got a MSE of 0.4256. The statement on Regarding exploration of interactive storybook app's read aloud function, which is more effectual has got a MSE of 0.4233. The statement on Multimedia e-book with minute digital interactivity, superior has got a MSE of 0.4354.

TABLE VII: STATISTICAL ANALYSIS ON INTERACTION LEVEL FOR CHILD STORY BOOK READING BEHAVIOUR

Statement	Mean	SD
More effectual one regarding story recall	4.58	1.25
More effectual one regarding word identification	4.12	1.13
Regarding exploration of interactive storybook app's read aloud function, which is more effectual (a) word recognition and story comprehension (b) taking a teacher guide using the app	4.88	1.68
Multimedia e-book with minute digital interactivity, superior (a) in supporting literacy accomplishment of pre-readers (b) in supporting an e-book with added digital interactivity	4.98	1.77

TABLE VIII: CORRELATION, VARIANCE AND MSE ANALYSIS ON INTERACTION LEVEL FOR CHILD STORY BOOK READING BEHAVIOUR

Statement	Correlation	Variance	R square	Adjusted R Square	MSE
More effectual one regarding story recall	0.422	0.547	0.430	0.437	0.4234
More effectual one regarding word recognition	0.437	0.523	0.401	0.423	0.4256
Regarding exploration of interactive storybook app's read aloud function, which is more effectual (a) word recognition and story comprehension (b) taking a teacher guide using the app	0.432	0.562	0.421	0.433	0.4233
Multimedia e-book with minute digital interactivity, superior (a) in supporting literacy accomplishment of pre-readers (b) in supporting an e-book with added digital interactivity	0.432	0.534	0.413	0.496	0.4354

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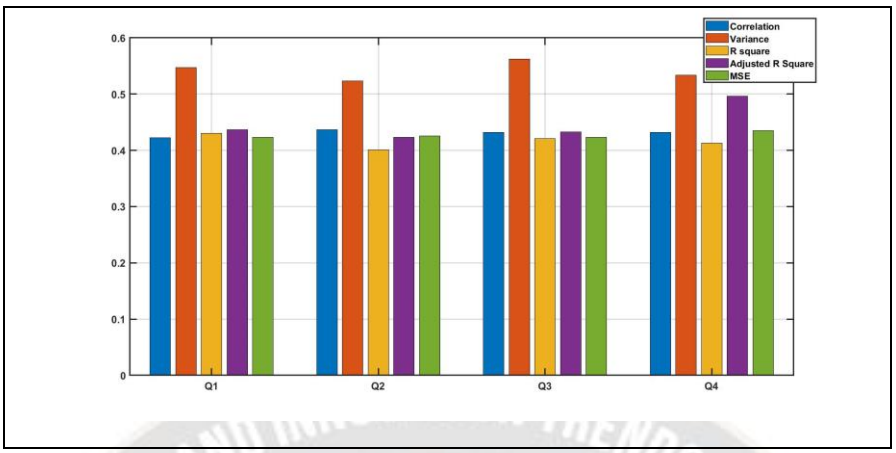

Figure 6: Correlation, variance and MSE analysis on interaction level for child story book reading behaviour

D. Child Learning ability level

The statistical analysis on child learning ability level for child story book reading behaviour is shown in Table IX. The statement on Real Stories and one with more visions on them has got a mean and SD of 4.53 and 1.25. The statement on Theme recognize with personalities and aid them deal with new problems or situations has got a mean and SD of 4.11 and 1.54. The statement on characters not generally fully developed has got a mean and SD of 3.95 and 1.78. The statement on Situation deployed for establishing story location in place and time, clarify historical background or create a mood has got a mean and SD of 4.77 and 1.24. The statement on Children who entangled in act, recognize issue, and unravel it quickly has got a mean and SD of 4.12 and 1.47. The statement on Need Enhancement of the story of the digital print book has got a mean and SD of 4.61 and 1.87. Often a rhythmic style of writing in the digital print book has got a mean and SD of 4.23 and 1.29. Surprise and the Unexpected has got a mean and SD of 4.58 and 1.44. The statement on Children simply recognize with the actions and emotions of characters has got a mean and SD of 4.88 and 1.11.

The analysis on correlation, variance and MSE analysis on child learning ability level for child story book reading behaviour is shown in Table X. The analysis on correlation, variance and MSE analysis on child learning ability level is revealed in graphical form in Fig. 7. The statement on Real Stories and one with more visions on them has got a MSE of 0.4114. The statement on Theme recognize with personalities and aid them deal with new problems or situations have got a MSE of 0.4214. The statement on Characters not generally fully developed has got a MSE of 0.4256. The statement on situation deployed for establishing story location in place and time, clarify historical background or create a mood has got a MSE of 0.4213. The statement on Children who entangled in act, recognize issue, and unravel it quickly has got MSE of 0.4154. The statement on Need Enhancement of the story of the digital print book has got a MSE of 0.4117. Often a rhythmic style of writing in the digital print book has got a MSE of 0.4554. Surprise and the Unexpected has got a MSE of 0.4112. The statement on Children simply recognize with the actions and emotions of characters have got a MSE of 0.4780.

TABLE IX: STATISTICAL ANALYSIS ON CHILD LEARNING ABILITY LEVEL FOR CHILD STORY BOOK READING BEHAVIOUR

Statement	Mean	SD
Real Stories and one with more visions on them	4.53	1.25
Theme re**cognize** with pe**rsonalities** and aid them deal with new problems or situations	4.11	1.54
Characters not generally fully developed.	3.95	1.78
Situation deployed for establishing story location in place and time, clarify historical background or create a mood.	4.77	1.24
Children who entangled in act, recognize issue, and unravel it quickly.	4.12	1.47
Need Enhancement of the story of the digital print book	4.61	1.87
Often a rhythmic style of writing in the digital print book	4.23	1.29
Surprise and the Unexpected	4.58	1.44
Children simply recognize with the actions and emotions of characters	4.88	1.11

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TABLE X: CORRELATION, VARIANCE AND MSE ANALYSIS ON CHILD LEARNING ABILITY LEVEL FOR CHILD STORY BOOK READING BEHAVIOUR

Statement	Correlation	Variance	R square	Adjusted R Square	MSE
Real Stories and one with more visions on them	.415	.513	.416	.411	.4114
Theme re**cognize** with pe**rsonalities** and aid them deal with new problems or situations	.399	.547	.410	.417	.4214
Characters not generally fully developed.	.417	.523	.401	.421	.4256
Situation deployed for establishing story location in place and time, clarify historical background or create a mood.	.412	.589	.421	.433	.4213
Children who entangled in act, recognize issue, and unravel it quickly.	.419	.514	.411	.496	.4154
Need Enhancement of the story of the digital print book	.385	.593	.429	.458	.4117
Often a rhythmic style of writing in the digital print book	.444	.541	.421	.407	.4554
Surprise and the Unexpected	.465	.539	.401	.410	.4112
Children simply recognize with the actions and emotions of characters	.458	.514	.411	.412	.4780

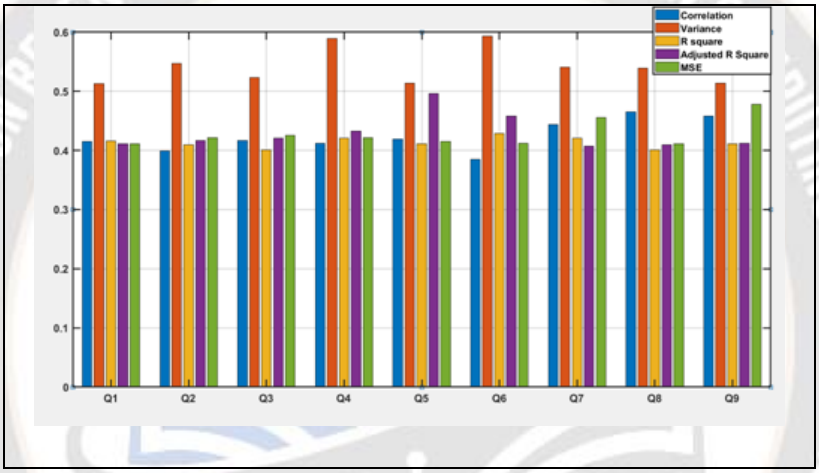

Figure 7: Correlation, variance and MSE analysis on Child Learning ability level for child story book reading behaviour

E. ANOVA analysis

The ANOVA analysis is shown in Table XI.

TABLE XI: ANOVA ANALYSIS

Characteristics	SS	df	MS	F	Probability > F
Groups	178974.8	5	35795	1.1	0.3599
Error	23987620.1	736	32591.9		
Total	24166594.9	741			

F. Correlation analysis

The correlation analysis is shown in Table XII. The correlation among the clusters (indicator 1, indicator 2 and indicator 3) is evaluated and the resultants are plotted in Table XII. The graphical representation of correlation analysis is shown in Fig. 8. Here, the correlation is high (value of 1) between the same clusters, i.e., cluster 1 and cluster 1, cluster 2 and cluster 2, cluster 3 and cluster 3. The correlation between two different clusters does not show much high values.

TABLE XII: CORRELATION ANALYSIS

Correlation coefficient values between the cluster	Cluster 1	Cluster 2	Cluster 3
Cluster 1	1	-0.011	0.011
Cluster 2	-0.011	1	-0.004
Cluster 3	0.011	-0.004	1

International Journal on Recent and Innovation Trends in Computing and Communication
ISSN: 2321-8169 Volume: 11 Issue: 3
DOI: https://doi.org/10.17762/ijritcc.v11i3.6336
***Article Received**: 18 December 2022 **Revised**: 26 January 2023 **Accepted**: 10 February 2023*

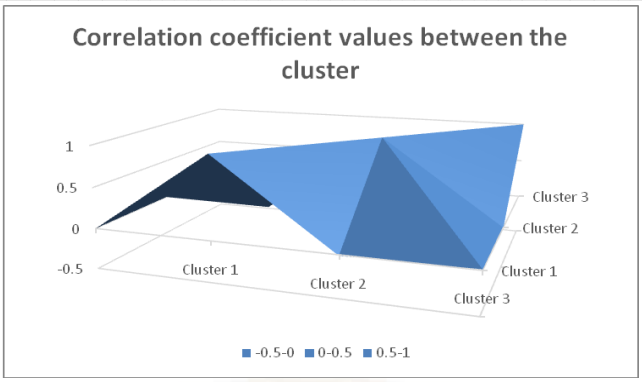

Figure 8: Correlation analysis among the clusters

G. Covariance analysis

The covariance analysis is shown in Table XIII. The covariance amongst the clusters (indicator 1, indicator 2 and indicator 3) is evaluated and the resultants are plotted in Table XIII. The graphical representation of correlation analysis is shown in Fig. 9. Here, the covariance is high (value of 1) among the similar clusters, i.e. cluster 1 and cluster 1, cluster 2 and cluster 2, cluster 3 and cluster 3. The covariance among two diverse clusters does not pose high values.

TABLE XIII: COVARIANCE ANALYSIS

Covariance between the cluster	Cluster 1	Cluster 2	Cluster 3
Cluster 1	1	-0.011	0.011
Cluster 2	-0.011	1	-0.006
Cluster 3	0.011	-0.006	1

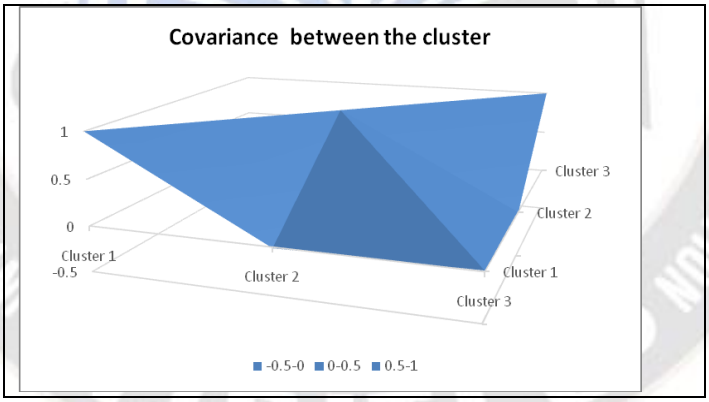

Figure 9: Covariance analysis among the clusters

VII. CONCLUSION

This paper makes an analysis on children's digital story book reading behaviour. Initially, the features (considered questions) were clustered using k means clustering model. In order to analyze the children's digital story book reading behaviour, the questions were made on different drivers such as (i) Characteristics of story book, (ii) Interaction level and (iii) Child learning ability level. The questions were analyzed based upon the responses obtained from 100 respondents with 46 males and 54 females. Based upon the clustering outputs, the regression analysis is made on correlation and covariance metrics. From analysis, the statement on Real Stories and one with more visions on them has got a MSE of 0.4114. The statement on Theme recognize with personalities and aid them deal with new problems or situations have got a MSE of 0.4214. The statement on characters not generally fully developed has got a MSE of 0.4256. The statement on Situation deployed for establishing story location in place and time, clarify historical background or create a mood has got a MSE of 0.4213. The statement on Children who entangled in act, recognize issue, and unravel it quickly has got MSE of 0.4154. The statement on Need Enhancement of the story of the digital print book has got a MSE of 0.4117. Often a rhythmic style of

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writing in the digital print book has got a MSE of 0.4554. Surprise and the Unexpected has got a MSE of 0.4112.

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