

Research on the Effect of Data Analysis-Based Integrated Activities for People with and without Disabilities on Enhancing Inclusive Literacy Among Adolescents

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Abstract: This study focuses on the enhancing effect of integrated activities for people with and without disabilities (hereinafter referred to as "integrated activities") on inclusive literacy among adolescents. Against the backdrop of increasing emphasis on the comprehensive development and inclusive concept of young people in society, the aim is to explore the impact of such activities on the literacy of young people. The study adopts an algorithm combining Analytic Hierarchy Process (AHP) and multiple linear regression model to determine the weights of influencing factors by constructing a hierarchical structure model, constructing a judgment matrix, and establishing a regression model to analyze the relationship between independent and dependent variables. Simultaneously design three types of integrated activities: salon sharing, accompanying peers, and online publishing. Select specific regions' school youth as the subjects, divide them into experimental and control groups for experiments, and collect data related to inclusive literacy before and after the activities through questionnaires. The results showed that the experimental group significantly improved their scores in cognitive, attitude, and behavioral dimensions after the activity, with an average score of 55.0 ± 4.8 in the cognitive dimension 6 months after the activity, compared to 41.2 ± 3.8 in the control group; The coefficient of determination R^2 of the model is 0.85, and the independent variables of each activity have a significant impact. This indicates that integrated activities have a significant effect on improving the inclusive literacy of adolescents, providing important references for the cultivation of adolescent literacy and the development of related activities.

Keywords: Integrated Activities; Adolescents; Inclusive Literacy; Data Analysis; Volunteer Service Platform.

1. Introduction

In today's era of pursuing social fairness and harmonious development, the cultivation of inclusive literacy of adolescents is increasingly prominent [1]. Inclusive literacy is not only related to the all-round development of adolescents, but also the key cornerstone of building a pluralistic, equal and inclusive society [2]. As an important part of social diversity, promoting adolescents' understanding and acceptance is an important way to improve adolescents' inclusive literacy, and integrated activities has become an effective way to achieve this goal [3].

At present, many scholars focus on the inclusive literacy of adolescents. Part of the research focuses on how to cultivate adolescents' tolerance consciousness through the innovation of curriculum and teaching methods in school education; Another study focuses on the influence of family environment and social and cultural factors on the formation of adolescents' inclusive concept [4-6]. However, the in-depth study on the promotion effect of integrated activities on adolescents' inclusive literacy is still insufficient, especially the systematic research based on data analysis is scarce.

Adolescents are in a critical period of forming their values. By participating in integrated activities, they have the opportunity to get in close contact with disabled groups, thus breaking their inherent cognition and enhancing their understanding and respect for different individuals [7]. Furthermore, integrated activities can provide real situations for adolescents, encourage them to cultivate empathy and sense of responsibility in interactive communication, and

effectively enhance their inclusive literacy [8].

Based on data analysis, this study explores the promotion effect of integrated activities on adolescent inclusive literacy. By designing and carrying out diversified integrated activities and using scientific data analysis methods to evaluate the effect of activities, the purpose is to clearly reveal the influence of such activities on adolescents' cognition, attitude and behavior. In addition, according to the research results, this study will also put forward suggestions on building a platform for youth voluntary service, hoping to provide reference for promoting the promotion of inclusive literacy of young people and the development of the cause of disability and health integration.

2. Cultivation of Adolescents' Inclusive Literacy and Analysis of Integrated Activities

At present, the cultivation of young people's inclusive literacy mainly depends on the cooperation of schools, families and society. In the school education system, the concept of tolerance is transmitted to adolescents through moral education courses and campus culture construction, but theoretical teaching is mostly and practical experience is less [9]. In family education, parents' ideas and educational methods have a far-reaching impact on children's inclusive literacy. However, some parents have limited understanding of inclusive ideas and it is difficult to give their children comprehensive guidance [10]. At the social level, all kinds of public welfare activities or publicity can enhance adolescents' cognition of special groups to a certain extent, but they lack

systematicness and continuity.

Integrated activities have obvious advantages in cultivating inclusive literacy of adolescents [11]. This kind of activity builds a platform for direct communication and interaction between adolescents and disabled groups, so that adolescents can really understand the life and needs of disabled groups and break the cognitive barrier. For example, participating in sports competitions and cultural performances together can enhance their emotional connection and cultivate adolescents' empathy and sense of responsibility.

However, integrated activities are also facing difficulties. It is difficult to organize activities, so it is necessary to coordinate various resources, including venues, personnel, materials, etc., and fully consider the special needs of disabled groups to ensure the safety and suitability of activities [12]. Furthermore, there is a lack of long-term mechanism for

activities, and it is often difficult to continue to advance steadily due to problems such as lack of funds and shortage of professional instructors.

Constructing a theoretical model based on data analysis can integrate all resources, provide scientific basis for the planning, implementation and effect assessment of integrated activities, and thus improve the inclusive literacy of adolescents more accurately.

3. Integrated Activities Design

In order to effectively improve the inclusive literacy of young people, three types of integrated activities are designed, namely salon sharing, accompanying peers and online publishing. The following is a detailed introduction to these three types of activities through Table 1:

Table 1. Design Details of Integrated Activities

Activity Type	Activity Content	Activity Purpose	Participants	Time Arrangement
Salon Sharing	Invite persons with disabilities to share their experiences, challenges, and achievements.	Help youth gain a deeper understanding of the lives of people with disabilities.	Representatives with disabilities, youth	Once a month, 2-3 hours each
Companion Activities	Organize outdoor activities or learning sessions for youth and persons with disabilities to participate in together.	Promote interaction between youth and people with disabilities, develop empathy and teamwork skills.	Youth, persons with disabilities, and volunteers	Once every two months, 3-5 hours each
Online Sharing	Create an online platform for youth to share their reflections and creative works from engaging with the disability community.	Expand the reach of the activities, raise awareness among more youth.	Youth	Ongoing, with regular selection and display of outstanding works

In the salon sharing activities, the sharing of real stories of disabled people can arouse emotional resonance among adolescents. For example, a blind person tells the story of learning Braille and trying to live independently, which can make adolescents realize its tenacity and difficulty. Accompany peers and enhance mutual trust by completing tasks together. Online publishing activities use the advantages of network communication to stimulate the enthusiasm and creativity of young people. These three kinds of activities complement each other, form a complete system, and help young people improve their inclusive literacy from different angles.

4. Algorithm Model and Experimental Verification

4.1. Algorithm Model

In order to comprehensively and deeply explore the promotion effect of integrated activities on adolescents' inclusive literacy, this study innovatively uses the algorithm combining AHP and multiple linear regression model to systematically analyze the data. This algorithm system can analyze the internal relationship between activities and literacy improvement from multiple dimensions, and provide more accurate and comprehensive theoretical support for research. In this study, an assessment framework of integrated activities based on data analysis is constructed, as shown in Figure 1.

When studying the influencing factors of the promotion effect of adolescent inclusive literacy, it is carefully divided

into three levels. The target layer is clearly defined as "the promotion of adolescents' inclusive literacy", which is the core direction of the whole study. The criterion layer covers key aspects such as cognition, attitude and behavior, which comprehensively reflect the components of adolescent inclusive literacy. The scheme layer specifically includes "salon sharing", "accompanying peers" and "online publishing activities", which are exactly the types of integrated activities designed in this study, and they are the specific implementation ways that affect the promotion of adolescents' inclusive literacy.

By carefully organizing experts' scoring, this article compares the importance of each element at the same level with respect to a criterion at the previous level, and then constructs a judgment matrix:

$$A=(a_{ij})_{n \times n} \quad (1)$$

a_{ij} here represents the proportional scale of the relative importance of element i and element j , and strictly satisfies the series characteristics of $a_{ij}>0, a_{ji}=1/a_{ij}, a_{ii}=1$. This rigorous construction ensures that the judgment matrix can accurately reflect the relatively important relationship between elements.

The next key step is to calculate the maximum feature root λ_{\max} of the judgment matrix A and its corresponding feature vector W . In order to get the accurate weight vector of each factor in the whole system, it is necessary to normalize the feature vector W . Among them, the formula for calculating the maximum characteristic root is:

In order to get the accurate weight vector of each factor in the whole system, it is necessary to normalize the feature vector W . Among them, the formula for calculating the

maximum characteristic root is:

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{(AW)_i}{W_i} \quad (2)$$

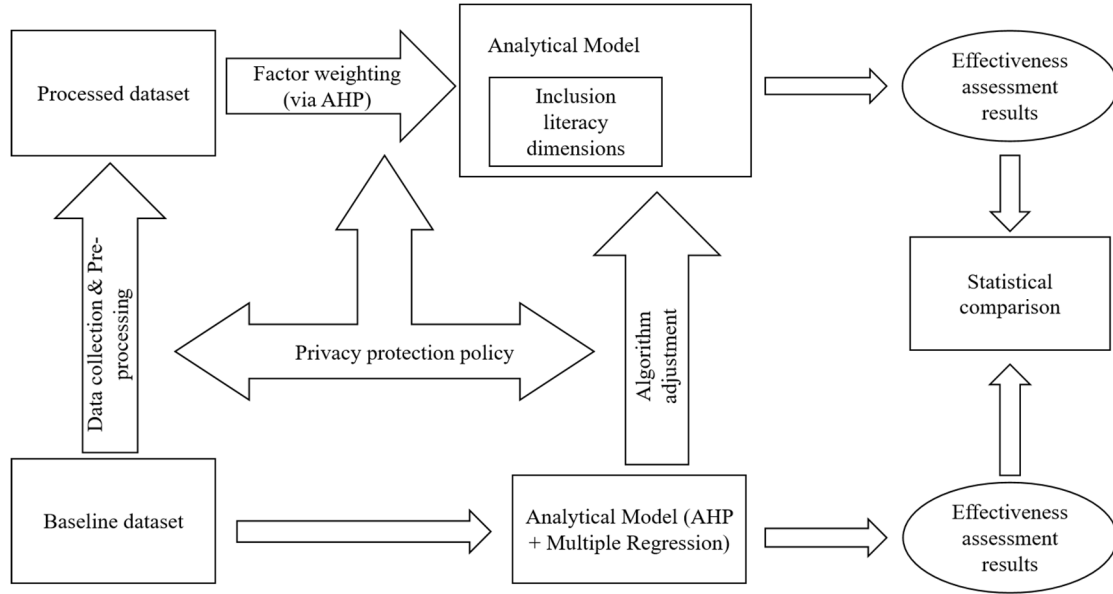


Figure 1. Framework for effect assessment of practical activities

$(AW)_i$ represents the i element of vector AW . This calculation process provides a key basis for determining the weight of each factor.

In order to ensure the rationality and reliability of the judgment matrix, consistency test is essential. Firstly, the consistency index is calculated:

$$CI = \frac{\lambda_{\max} - n}{n-1} \quad (3)$$

Then search the corresponding average random consistency index RI according to the matrix order n number, and then calculate the consistency ratio:

$$CR = \frac{CI}{RI} \quad (4)$$

When $CR < 0.1$, it shows that the judgment matrix has satisfactory consistency and can provide a reliable basis for subsequent analysis. On the other hand, if $CR \geq 0.1$, the judgment matrix needs to be adjusted appropriately to ensure the accuracy of the analysis results.

(2) Multiple linear regression model

In the study, let the improvement degree of adolescents' inclusive literacy be Y , the participation in salon sharing activities be X_1 , the participation in accompanying peers' activities be X_2 and the participation in online publishing activities be X_3 , and then construct a multiple linear regression model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon \quad (5)$$

Among them, β_0 is the constant term, $\beta_1, \beta_2, \beta_3$ are the regression coefficients of the corresponding independent variables. They reflect the influence of different activities on the improvement of adolescents' inclusive literacy. ϵ is a random error term, which is used to cover other random factors that are not explained in the model.

In order to estimate the regression coefficient accurately, the least square method is used in this study. Its core goal is to minimize the sum of squares of residuals Q :

$$Q = \sum_{i=1}^n (y_i - \hat{y}_i)^2 \quad (6)$$

Here y_i represents the actual observed value, while \hat{y}_i is the predicted value:

$$\hat{y}_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} \quad (7)$$

Through this method, it is possible to find the regression

coefficients that best fit the data. The estimation formula for regression coefficients is:

$$\hat{\beta} = (X^T X)^{-1} X^T Y \quad (8)$$

Among them, X is the independent variable matrix, which integrates the observation data of all independent variables, and Y is the dependent variable vector, which includes the actual observation values of the degree of improvement of inclusive literacy among adolescents. With the help of this method, each regression coefficient can be accurately estimated, and the specific influence of different integrated activities on the promotion of adolescent inclusive literacy can be analyzed.

4.2. Experimental Verification

Table 2. Comparison of Cognitive Dimension Scores Between Experimental and Control Groups Before and After Activities

Stage	Experimental Group Score (Mean \pm SD)	Control Group Score (Mean \pm SD)
Pre-activity	35.2 \pm 3.1	34.8 \pm 2.9
1 month post-activity	42.5 \pm 3.5	36.1 \pm 3.0
2 months post-activity	45.6 \pm 3.8	37.2 \pm 3.2
3 months post-activity	48.1 \pm 4.0	38.5 \pm 3.3
4 months post-activity	50.2 \pm 4.2	39.1 \pm 3.5
5 months post-activity	52.8 \pm 4.5	40.0 \pm 3.6
6 months post-activity	55.0 \pm 4.8	41.2 \pm 3.8

In this experiment, adolescents from five schools were selected as the research objects and randomly divided into experimental group and control group, with 100 people in each group. The experimental group participated in the three kinds of integrated activities designed, while the control group did not participate in the activities. Before and after the activity, two groups of adolescents were investigated by questionnaire to collect relevant data about inclusive literacy, including cognition, attitude and behavior. By sorting out the

data of the questionnaire, the following three tables, Table 2, Table 3 and Table 4, are drawn to show the changes of various dimensions of adolescent inclusive literacy.

From Table 2, it can be seen that the cognitive scores of the experimental group and the control group before the activity were similar, indicating that the cognitive level of the disabled group was comparable between the two groups of adolescents in the initial state. After the activity, the scores of the experimental group significantly improved month by month, reaching 42.5 ± 3.5 after one month and 55.0 ± 4.8 after six months, indicating that integrated activities effectively enhanced the cognitive abilities of the experimental group's adolescents towards the disabled population. In contrast, although the control group also showed an increase, the magnitude was much smaller than that of the experimental group, only 41.2 ± 3.8 after 6 months. This indicates that the control group who did not participate in the activity showed a significant lag in cognitive improvement, highlighting the positive role of practical activities in promoting cognitive development in adolescents.

Table 3. Comparison of Attitude Dimension Scores Between Experimental and Control Groups Before and After Activities

Stage	Experimental Group Score (Mean \pm SD)	Control Group Score (Mean \pm SD)
Pre-activity	32.5 \pm 2.8	32.2 \pm 2.7
1 month post-activity	38.0 \pm 3.2	33.5 \pm 2.9
2 months post-activity	41.5 \pm 3.5	34.8 \pm 3.0
3 months post-activity	44.0 \pm 3.7	35.5 \pm 3.1
4 months post-activity	46.8 \pm 4.0	36.2 \pm 3.2
5 months post-activity	49.5 \pm 4.2	37.0 \pm 3.3
6 months post-activity	52.0 \pm 4.5	38.1 \pm 3.5

Observing the data in Table 3, there was not much difference in attitude dimension scores between the experimental group and the control group before the activity. As the activity progressed, the attitude score of the experimental group steadily increased, reaching 38.0 ± 3.2 one month after the activity and 52.0 ± 4.5 six months later, reflecting that the activity promoted a more positive attitude towards disabled groups among the experimental group of adolescents. Although the attitude score of the control group increased, the speed was slow, reaching 38.1 ± 3.5 after 6 months. This indicates that integrated activities have shown

Table 6. Model Performance Assessment (Error Metrics)

Assessment Metric	Training Set	Test Set	Cross-Validation Folds	Linear Kernel	Gaussian Kernel	Regularization 0.1	Regularization 1	Sample Size 100	Sample Size 500
MSE	0.045	0.055	5	0.048	0.052	0.042	0.058	0.040	0.050
RMSE	0.21	0.23	5	0.215	0.225	0.205	0.235	0.20	0.22
MAE	0.17	0.19	5	0.175	0.185	0.165	0.195	0.16	0.18

Table 5 presents key model performance indicators. The coefficient of determination R^2 is 0.85, indicating that the model fits the data well and can explain most of the variation in the dependent variable. The t-values of β_1 , β_2 , and β_3 were 3.56, 4.21, and 3.89, respectively, and all were significant, indicating that the three independent variables of salon sharing, accompanying peers, and online publishing

significant effectiveness in improving attitudes towards disabled groups among adolescents, effectively guiding them to form more inclusive attitudes.

Table 4. Comparison of Behavioral Dimension Scores Between Experimental and Control Groups Before and After Activities

Stage	Experimental Group Score (Min, Q1, Median, Q3, Max)	Control Group Score (Min, Q1, Median, Q3, Max)
Pre-activity	28, 32, 34, 36, 39	27, 31, 33, 35, 38
1 month post-activity	35, 38, 40, 42, 45	29, 33, 35, 37, 40
2 months post-activity	38, 41, 43, 45, 48	30, 34, 36, 38, 41
3 months post-activity	40, 43, 45, 47, 50	31, 35, 37, 39, 42
4 months post-activity	42, 45, 47, 49, 52	32, 36, 38, 40, 43
5 months post-activity	45, 48, 50, 52, 55	33, 37, 39, 41, 44
6 months post-activity	48, 51, 53, 55, 58	34, 38, 40, 42, 45

Table 4 shows the scores of behavioral dimensions, and the distribution of behavioral performance between the experimental group and the control group before the activity is similar. After the activity, the experimental group showed significant improvements in the minimum, median, and maximum values in the behavioral dimension. For example, after 6 months of activity, the minimum value increased to 48 and the maximum value reached 58, indicating that the adolescents in the experimental group were more proactive in interacting with disabled groups. Although there were some changes in the control group, the magnitude was relatively small, with a minimum value of 34 and a maximum value of 45 after 6 months. From this, it can be seen that integrated activities effectively promote the acceptance and assistance of disabled groups in the experimental group of adolescents, and have a positive impact on adolescent behavior change.

To evaluate the performance of the model, the prediction results of the regression model were analyzed, and the results are shown in Tables 5 and 6.

Table 5. Model Performance Assessment

Assessment Metric	Value
Coefficient of Determination R^2	0.85
t-value of β_1	3.56 (significant)
t-value of β_2	4.21 (significant)
t-value of β_3	3.89 (significant)

activities have a significant impact on the improvement of adolescent inclusive literacy. The model has good explanatory power.

Table 6 Assessment of model performance based on focus error indicators. MSE, RMSE, and MAE show little difference in values between the training and testing sets, indicating good model stability. Under different kernel

functions, regularization parameters, and sample sizes, although these error indicators fluctuate, the overall change amplitude is small, indicating that the model has certain adaptability to different conditions and the results are relatively reliable.

5. Conclusion

This study explores the improvement effect of integrated activities on the inclusive literacy of adolescents through the comprehensive use of AHP and multiple linear regression models. The results indicate that integrated activities have a positive and significant effect on enhancing the inclusive literacy of adolescents. In terms of cognition, the scores of the experimental group and the control group before the activity were similar, at 35.2 ± 3.1 and 34.8 ± 2.9 , respectively. However, after 6 months of activity, the scores of the experimental group increased to 55.0 ± 4.8 , while the control group was only 41.2 ± 3.8 . This indicates that the activity greatly enhances young people's understanding of the disabled community. In terms of attitude dimension, the activity prompted the experimental group of adolescents to have a more positive attitude towards the disabled population, with a score of 52.0 ± 4.5 6 months after the activity, which was relatively small compared to the control group. The same applies to the behavioral dimension, where the experimental group becomes more proactive and positive in interacting with disabled individuals.

In addition, the performance assessment results of the model also provide strong support for the research. The coefficient of determination R^2 reaches 0.85, indicating that the model has a good fit to the data and can effectively explain the relationships between variables. Furthermore, the t-values of the regression coefficients β corresponding to each activity factor are significant, further confirming the significant impact of salon sharing, accompanying peers, and online publishing activities on the improvement of adolescent inclusive literacy.

In summary, integrated activities are an effective way to enhance the inclusive literacy of young people. Based on this, it is recommended to establish a youth volunteer service platform to carry out such activities on a regular basis, further promote the continuous improvement of youth inclusiveness, and lay a solid foundation for creating a more inclusive and harmonious social environment. This study has certain limitations in sample selection and geographical coverage. Future research can further expand on this basis to obtain more universal conclusions.

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