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Research on User Interface Design and Interaction Experience: A Case Study from "Duolingo" Platform

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Abstract

INTRODUCTION: In today's information age, user interface design and interaction experience are crucial to the success of online platforms.
OBJECTIVES: Through in-depth analysis of the user interface design features and user interaction experience of the "Duolingo" platform, this study reveals the potential correlation between them and proposes effective improvement methods to enhance user satisfaction and efficiency.
METHODS: Interaction design principles were adopted to guide the improvement and optimization of the user interface. These principles include usability, consistency, and feedback to improve overall user satisfaction with the platform by actively considering user behavior and needs in the design. At the same time, specific mathematical models and equations are used to quantitatively analyze the efficiency and smoothness of the user interaction process, providing designers with more precise directions for improvement.
RESULTS: Optimized user interface design and interaction experience can significantly improve user satisfaction and usage efficiency. Users operate the platform more smoothly, which provides useful reference and guidance for the design and development of e-learning platforms.
CONCLUSION: Through in-depth analysis of the case of the "Duolingo" platform and the introduction of user experience evaluation methods and interaction design principles, this study has come up with a series of effective improvement measures and verified their effectiveness through experiments. It has certain theoretical and practical significance for improving the user experience of online learning platforms and promoting the design and development of Internet products.

Keywords: user interface design, information age, online platforms, interaction experience

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1 Introduction

In today's digital era, user interface design and interaction experience play a crucial role in Internet products and services. With the popularization of mobile devices and the Internet, users have become more and more attached to the experience and usage feeling of product interfaces, and the quality of user interface design and the smoothness of interaction experience directly affect user satisfaction and loyalty(Todi et al., 2021). Excellent user interface design can not only improve the ease of use and attractiveness of the product but also enhance the user experience, and increase user satisfaction and loyalty, thus bringing more business value to the enterprise.

Especially for products such as online learning platforms, user interface design and interaction experience are even more crucial(Cheng et al., 2022). In the field of education, the user learning experience is directly related to the learning effect and motivation. A friendly, clear, and easy-to-use user interface allows learners to access the required information more easily, conduct learning activities more effectively, and improve learning efficiency and results. At the same time, a good interactive experience can also enhance the learner's sense of participation and engagement, and improve the fun and attractiveness of learning(Shah & Nasnodkar, 2021). Therefore, for online learning platforms, it is crucial to optimize the user interface design and enhance the interaction experience, which not only attracts more users, but also improves their learning motivation and satisfaction, and promotes the development of education.

As a popular online language learning platform, "Duolingo" is loved by users for its simple and intuitive interface design and rich and diverse learning functions. The platform provides a wide range of language learning courses covering vocabulary, grammar, listening, speaking, and other aspects to meet the different learning needs of users(Xu et al., 2024). Meanwhile, the platform adopts a game-based learning mode, which enhances users' motivation and participation through the design of a level setting and reward mechanism. In addition, the platform also provides social functions that allow users to interact with other learners and share their learning experiences and tips. Overall, the platform has attracted a large number of users with its rich learning content, innovative learning mode, and convenient user experience.

However, in the face of changing user needs and a competitive market environment, there is still room for further improvement and optimization of the "Duolingo" platform(Miraz et al., 2021). Through in-depth analysis of its user interface design and interactive experience, the authors find some problems and potential room for improvement and further optimize the user interface design and interactive experience to enhance user satisfaction and loyalty, which is of great significance to the sustainable development of "Duolingo" platform and the enhancement of user experience(Barta et al., 2021). Therefore, this thesis selects the "Duolingo" platform as the research object, explores the relationship between user interface design and interactive experience, and proposes corresponding optimization strategies to provide theoretical and practical support for the quality of user experience of e-learning platforms.

This thesis explores how to optimize the quality of user experience of e-learning platforms through an in-depth study of the relationship between user interface design and interactive experience(Sun et al., 2022). Through in-depth analysis of the user interface design features and interactive experience of the "Duolingo" platform, problems and room for improvement are identified(Sharma et al., 2023). By observing and evaluating the interface layout, graphic design, interaction elements, etc., the author reveals the potential problems and provides a basis for subsequent optimization. At the same time, the user interface design is systematically evaluated and analyzed by applying user experience evaluation methods and interaction design principles(Abdurakhimovich, 2023). Questionnaire surveys and user interviews are used to obtain direct feedback from users on their experience of using the platform, and interaction design principles are used to guide the improvement and optimization of the interface design, to improve the overall satisfaction of users with the platform. In addition, corresponding optimization strategies and specific improvement measures are proposed to improve users' interaction experience on the platform of "Duolingo"(Al Rawashdeh et al., 2021). Drawing on relevant theories and methods of user interface design and interaction experience optimization, and combining them with the characteristics of the "Duolingo" platform, the author proposes targeted optimization solutions to improve the quality and effect of user experience.

Finally, the effectiveness of the proposed optimization strategy is verified through experiments, and the research results are summarized to provide reference and guidance for the user interface design and interactive experience of the online learning platform(Chromik & Butz, 2021). A series of user tests are designed and implemented to verify the effectiveness of the optimization strategy and summarize the research results to provide theoretical and practical support for improving the user experience of online learning platforms.

2 User Interface Design Analysis

2.1 Overview of the Duolingo Platform

Carnegie Mellon University's Duolingo is a gamified, free language learning platform that takes its name from the Latin roots, Duolingo (language). With the mission of personalized education, creative learning, instant learning, and equality in education, "Duolingo" provides learning courses in up to 40 languages, including not only major world languages such as Chinese, English, Spanish, French, and Russian, but also cold languages such as Romanian and Kiswahili, as well as endangered languages such as Navajo, and even relatively mature and manmade languages such as Esperanto and Vulgarian(Ilham et al., 2021). Users can choose different courses and learning content according to their own learning needs and interests(Prati et al., 2021). The learning content of the platform is carefully designed and produced by a team of professional language education experts and teachers to ensure the quality and reliability of the content. "The platform adopts a game-based learning model, which stimulates users' interest and motivation by setting up levels and reward mechanisms.

Taking mobile as the research object, the interface design of “Duolingo” is very simple and clear, following the design principle of minimalist style(Paneru et al., 2024). The main interface usually takes a bright background color as the background, with simple icons and clear text, and the navigation bar at the bottom enables users to quickly find the required functions, reducing the cognitive burden of learning(Felix & Rembulan, 2023). Meanwhile, the interface jumping between “Duolingo” adopts an intuitive learning path design, which divides the learning content into different courses and themes, so that users can choose the learning content according to their own learning needs and interests. Each course has clear objectives and learning progress, so users can clearly understand their learning progress.However, Duolingo, a popular language learning application, despite its success in many aspects, still has some interface design deficiencies. These deficiencies may affect the learning experience and the effectiveness of the user's usage. The interface design of Duolingo lacks some advanced features and personalization setting options. While maintaining a simple and clean interface, users may need more customization and personalization options to meet their specific learning needs and preferences(Mogaji et al., 2021). The lack of these advanced features and setting options may limit the user's learning experience and learning effectiveness. In addition to this, the interface of “Duolingo” lacks a clear hierarchical structure of information, which makes it difficult for users to understand the organization and association of the page content while browsing and using it. For example, the Personal Center - Learned Languages can only view the language the people are learning, not edit it. The entrances for editing are in the main interface - Language Learning interface and Settings - Courses, the latter of which has a very deep entry(Holly et al., 2021). The lack of a clear hierarchy of information may make users feel lost or overwhelmed, affecting their overall understanding and experience of using the application. In addition, interfaces with “Duolingo” may suffer from poorly laid out functionality, resulting in unnecessary browsing and clicking when users are looking for a specific function. Functional elements on the interface should be reasonably laid out according to the user's needs and habits to improve the user's efficiency and experience. Sapphire Shop is very hidden, with a small screen occupying the area of the entrance point but a large number of functions(Ameen et al., 2021). On the one hand, users are already accustomed to the gameplay of exchanging points for items, but they can't find the entrance and don't know how to use the earned gems, on the other hand, the Sapphire Shop undertakes part of the business goals, which is too hidden and not conducive to the achievement of the goals.

2.2 User Experience Assessment Methodology

The use of user experience assessment methods is essential when analyzing and optimizing user interface design. UX assessment methods aim to assess the quality of user experience of a product or service by collecting and analyzing user feedback and behavioral data to identify problems and make suggestions for improvement. Commonly used UX evaluation methods include questionnaires, user interviews, usability testing, and eye tracking.

Questionnaires are a common method of user experience evaluation, providing users with a series of questions to collect their opinions, views, and feelings. The questionnaire can include questions about interface design, function use, satisfaction, etc. By counting and analyzing the results of the questionnaire, the author can understand the overall evaluation and demand of the product from the users and find out the existing problems and room for improvement. User interviews, on the other hand, provide an in-depth understanding of users' needs and experiences, exploring their usage, preferences, pain points, etc. through face-to-face communication and discussion with users. Through open-ended questions and in-depth discussions, more specific and in-depth user feedback can be obtained, providing more direct and effective suggestions for product improvement and optimization. Usability testing can quantitatively evaluate the user interface design, allowing users to complete a series of specified tasks, observing and recording their operating behavior and reaction time to evaluate the product's ease of use and efficiency. Usability testing can help to identify problems and difficulties encountered by users in the process of using the product, and then target to improve the product design to enhance user satisfaction and experience. In addition, eye tracking is a method used to study users' gaze and attention on an interface, analyzing the distribution of users' attention and behavioral paths on an interface by recording the trajectory of users' eye movements and gaze points. Eye tracking can help reveal users' attention preferences and behavioral habits on interface design and provide objective data support for interface optimization.

When analyzing and optimizing the user interface design of the Duolingo platform, two specific approaches are recommended: user interviews and usability testing.

User interviews can provide in-depth and specific user feedback to help researchers better understand users' needs, preferences, and experiences. Through face-to-face communication and open-ended questioning, it is possible to explore users' feelings and opinions about the platform's interface design and to discover the problems and difficulties they encounter in the process of using it(Rashidi & Nili, 2022). User interviews can also understand users' habits and behavioral patterns, providing direct suggestions and guidance for interface design improvement.

While usability testing can quantitatively assess the ease of use and efficiency of user interface design, it

evaluates the experience of using a product by allowing users to complete a series of specified tasks and observing and recording their operating behavior and reaction time. Usability testing can help identify specific problems and obstacles encountered by users in the process of using the product, assess the learning curve and operational efficiency of users, and provide objective data support for product improvement and optimization(Mathur et al., 2021). By comprehensively analyzing the results of user interviews and usability testing, the author gets a comprehensive understanding of users' needs and feedback on the interaction experience and interface design of the platform, which will provide strong support for the development of optimization strategies.

Therefore, the combined use of user interviews and usability testing can provide a comprehensive understanding of user needs and feedback on the user interface design and interaction experience of the "Duolingo" platform in terms of both depth and breadth. Through the combination of qualitative and quantitative analysis, the author can provide a scientific basis and effective methods for the optimization of interface design.

2.3 User Interface Design Optimization Strategies

The optimization of user interface design is a key part of improving the quality of user experience. When exploring the optimization strategy of user interface design, it is first necessary to take into account the user's habits and behavioral patterns, as well as the usability and ease of use of the interface design. In the implementation of the optimization strategy, it is also necessary to consider the feedback of the interface and the monitoring of user experience. By introducing a monitoring system and analysis tools for the user interface, user behavior and feedback can be monitored in real-time, and problems and room for improvement of the interface can be found in time. Therefore, some specific equations and algorithms can be introduced to quantitatively analyze the effects of user experience and interface design. One of the commonly used methods is to utilize the user satisfaction (Satisfaction, SAT) indicator to evaluate the quality of user experience. User satisfaction can be calculated by the following equation:

$$\mathrm{SAT} = \frac{P - E}{E} \times 100\% \tag{1}$$

In equation (1), P represents the user's actual feeling or satisfaction score and E represents the user's expectation or anticipation score. By comparing the difference between the actual feeling and the expected score, the user's satisfaction with the interface design can be assessed. If the SAT value is positive, it means that the user's actual feeling is higher than the expectation, and vice versa, it means that the user's actual feeling is lower than the expectation.

In addition, a Decision Tree algorithm (DT) can be introduced to analyze the user's behavioral data and feedback to predict the user's preferences and needs. Decision Tree algorithm is a classification model based on tree structure, which can classify or predict data based on feature values. In user interface design optimization, decision tree algorithms can be used to analyze user behavioral data and feedback information to predict user preferences and needs. The process of constructing a decision tree involves the calculation of metrics such as information gain or Gini index, which is represented by the following equation:

$$M = s(all) - \sum_{i=1}^{n} \frac{N_i}{N} \times s(S_i) \tag{2}$$

In Equation (2), M denotes the information gain, s denotes the information entropy, N denotes the overall number of samples, N_i denotes the number of samples under the i^{th} eigenvalue, S_i denotes the set of samples corresponding to the i^{th} eigenvalue, and n denotes the number of eigenvalues.

The information entropy is calculated by the equation:

$$s(S) = -\sum_{i=1}^{m} p_i \times \log_2(p_i) \tag{3}$$

In Equation (3), m denotes the number of categories in the sample, and p_i denotes the probability that the i^{th} category occurs in the sample set S.

According to the calculation results of information gain or Gini index, the best splitting features and splitting points can be determined, to construct the decision tree model. Through the mining and analysis of user behavior data, the decision tree algorithm can discover the interests and preferences of users and provide a basis for the personalization and differentiation of interface design.

3. Interactive experience research

3.1 Interaction Design Principles

Interaction design is a crucial part of interaction experience research, which directly affects users' experience and satisfaction with a product or service. The basic principles and methods of interaction design are guidelines and methodologies to guide designers in interface design and interaction design, aiming to improve the usability, ease of use, and user satisfaction of products. In introducing the basic principles and methods of interaction design, it is first necessary to focus on user needs and behaviors and put the user at the center of the design. This means that designers need to have an in-depth understanding of the characteristics, preferences, and habits of the target user group, as well as their behavioral patterns and needs when using the product.

In addition, one of the basic principles of interaction design is simplicity. Simplicity means that the interface design should be as simple and clear as possible, avoiding

complex operations and redundant functions, so that users can easily understand and use the product. By simplifying the interface layout, streamlining the functional options, and optimizing the operation flow, the cognitive load and learning cost of users can be reduced, and the ease of use and user satisfaction with the product can be improved. The main interface design of Duolingo can be made more simple and intuitive according to this principle, with icons and text as the main elements, clearly presenting various functions and learning contents. So that users can easily find the required functions, reducing the complexity and cognitive burden of the interface, while Duolingo provides users with clear learning feedback and reward mechanisms, and users can get real-time feedback and rewards through simple operations.

At the same time, interaction design should also focus on the principle of Consistency. Consistency means that the interface design should be unified and coherent, following the same design style, layout specification, and operation logic, so that users can easily find the required functions and information, and reduce the confusion and bewilderment of users. Through a unified visual style, similar interaction patterns, and consistent feedback mechanisms, the user experience and trust can be enhanced, improving the reliability and stability of the product. Duolingo maintains a uniform interface style throughout the application, including consistency in design elements such as colors, fonts, and icons. No matter which page or function module users are on, they can feel a similar visual style. In addition to this, Duolingo should provide users with unified feedback and prompt information, whether it is the feedback of answering questions during the learning process or the system prompts of the application, all of which maintain a consistent style and language. This makes it easier for users to understand and recognize different types of feedback, improving their learning efficiency and experience, which also reflects the consistency of interaction design.

In addition, Predictability is one of the important principles of interaction design. Predictability means that the interface design should be in line with the user's expectations and habits so that the user can accurately predict and understand the product's behavior and feedback. Through reasonable interface feedback and prompt information, as well as interaction methods that conform to the user's mental model, user satisfaction and trust can be improved, and the predictability and credibility of the product can be enhanced.

Principles such as Feedback and Controllability are also important components of interaction design. The principle of Feedback emphasizes that when users interact with the system, the system should provide timely feedback information to inform users of the results and status of their operations, to reduce users' uncertainty and anxiety. The principle of controllability emphasizes that the user should have control over the product, and can independently choose and adjust the settings and functions of the product to meet personalized usage needs and preferences.

The basic principles and methods of interaction design include user needs and behavior analysis, simplicity, consistency, predictability, feedback and controllability, and many other aspects. By following these principles and methods, designers can improve the usability, ease of use, and user satisfaction of their products, thereby increasing their competitiveness and market value.

3.2 User Behavior Analysis

In interaction experience research, analyzing user behavior on a "Duolingo" platform is a key step in understanding user needs and optimizing interface design. the author can focus on the user's login and registration behaviors. Users usually need to register and log in to enjoy the full learning functions on the platform, The author can observe the number of registrations and the frequency of logging in to understand the activity and loyalty of users.

Secondly, the learning behavior of users can be analyzed. Users can choose different courses and learning contents, so they can observe their learning preferences and learning habits. For example, the types of courses, study duration, and study frequency chosen by users can be analyzed to understand their interest in and importance of different learning contents.

In addition, it is also possible to focus on the user's interaction behavior. Users can interact with the interface by clicking, browsing, searching, etc., so the user's operation behavior and path can be observed. For example, users' clicking hotspots and browsing trajectories can be analyzed to understand users' focus and behavioral habits on the interface.

In addition, the social behavior of users is also worthy of attention. On the "Duolingo" platform, users can interact with other learners and share learning experiences and tips, so it is possible to observe their social activities and interaction frequency. For example, the number of posts, comments, and likes can be analyzed to understand the activity and influence of users on social platforms.

The behavioral characteristics of users on the platform of "Duolingo" include login and registration behaviors, learning behaviors, interaction behaviors, social behaviors, and other aspects. Through in-depth analysis of user behavioral data and behavioral paths, the author can comprehensively understand user needs and behavioral patterns, and provide scientific basis and effective methods for interface design optimization.

3.3 Interaction Experience Optimization Algorithm

In interaction experience research, specific algorithms and equations for optimizing the interaction experience are crucial for improving the user satisfaction and competitiveness of a product. The following are commonly used algorithms and equations for optimizing interaction experience.

The first is a recommendation algorithm for user behavioral data. Recommendation algorithms recommend personalized content and services for users by analyzing their behavioral data and preferences, thereby increasing user satisfaction and engagement. Among them, the collaborative filtering algorithm is a commonly used recommendation algorithm, which recommends content or products similar to their interests for users based on the similarity and relevance of their behavioral data. The equation of the collaborative filtering algorithm is as follows:

$$r_{u,i} = \frac{\sum_{u \in N} sim(u,v) \cdot r_{v,i}}{\sum_{v \in N} sim(u,v)} \quad (4)$$

In Equation. (4), $r_{u,i}$ denotes the predicted value of the user's rating for item i, N denotes the set of users similar to user u, $sim(u,v)$ denotes the similarity between user u and user v, and $r_{v,i}$ denotes the value of user v's rating for item i.

Meanwhile, in the interface optimization algorithm based on eye-tracking data, the eye-tracking data can reflect the user's attention distribution and behavioral path on the interface, so the eye-tracking data can be used to optimize the interface. Among them, heatmap analysis is a commonly used eye-tracking analysis method, and by generating the heatmap of the interface, it can intuitively show the hotspots of the user's attention and behavioral paths on the interface, to provide a basis for the optimization of the interface design.

Finally, it is an interaction experience optimization algorithm based on the user satisfaction model, which is a mathematical model used to quantitatively analyze the user's satisfaction with a product or service and to predict the user's satisfaction level in different scenarios. Among them, a linear regression model is a commonly used user satisfaction model, which analyzes the user's rating data and related factors to establish a linear relationship between user satisfaction and the influencing factors, to predict the user's satisfaction level. The equation of the linear regression model is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_n X_n + \in \quad (5)$$

Where Y denotes the predicted value of user satisfaction, X_1, X_2, ..., Xn denotes the factors affecting user satisfaction, β denotes the regression coefficient, and $\in$ denotes the error term.

4 Experimental design and result analysis

4.1 Experimental design

An experiment was designed to study the interaction experience, targeting the "Duolingo" platform. The purpose of the experiment is to evaluate the impact of different interface design options on the user interaction experience, with a special focus on the user's attraction to the learning content and the ease of use of the interface. The purpose and hypothesis of the experiment are to evaluate the impact of different interface design solutions on the user experience of the "Duolingo" platform and to hypothesize that the optimized interface design can improve the attractiveness of the learning content and the ease of use of the interface. The experimental subjects are the registered users of the "Duolingo" platform, and 500 registered users are randomly selected as the experimental subjects to ensure the representativeness and credibility of the samples. In this experimental design, the interface design scheme is taken as the experimental variable, including the changes in color, layout, font, and other elements, while controlling the type and quality of the learning content and the stability of the platform's functions. The experimental subjects were randomly assigned to different experimental and control groups, with the control group adopting the original interface design and the experimental group adopting the interface design optimized according to the interaction principle. The experimental methods can be chosen from online experiments or laboratory experiments, and the experimental tools can include eye-tracking technology, questionnaires, and user interviews. The experimental process includes the preparation before the experiment, data collection during the experiment, and data analysis after the experiment to evaluate the data results of different experimental groups to determine the effectiveness of the interface design scheme. Through this experimental design, the author evaluates the impact of different interface design solutions on the user experience of the "Duolingo" platform and provides a scientific basis and effective method for the optimization of interface design.

4.2 Analysis of experimental results

In the part of user attention distribution, the data on user attention distribution under different interface design schemes in the experimental results will be analyzed in detail. By recording the distribution of users' attention to the learning content during the experiment through eye-tracking technology, it is possible to understand the degree of attraction of different design schemes to users' attention. It was observed that in the experimental group, users paid more attention to the learning content compared to the control group. Specifically, in the experimental group, the average duration of users' attention to the learning content was 15 seconds, compared to 10 seconds in the control group. This indicates that the optimized interface design can better attract users' attention and make them more focused on the learning content. To show the experimental results more intuitively, the proportion of users' attention to the learning content in the experimental group and the control group in different periods is compared through the table, as shown in Table 1.

Table 1 Comparison table of the level of attention to the content of learning

Period (seconds)	Experimental group (proportion of gaze learning content)	Control group (proportion who gaze at learning content)
0-5	20%	15%
6-10	25%	18%
11-15	30%	20%
16-20	25%	16%
21-25	20%	14%
26-30	10%	12%

From the above table, it can be seen that in the experimental group, the proportion of users looking at the learning content in each period is higher than that of the control group. Especially in the periods of 11-15 seconds and 16-20 seconds, the proportion of users in the experimental group looking at the learning content is significantly higher than that in the control group. This further confirms that the optimized interface design can attract users' attention more effectively. In addition, a bar chart as shown in Figure 1 is drawn to compare the proportion of users' attention to the learning content in the experimental and control groups in different periods more intuitively. By comparing the bar charts, the trend that users in the experimental group pay more attention to the learning content throughout the learning process compared to the control group can be seen more clearly.

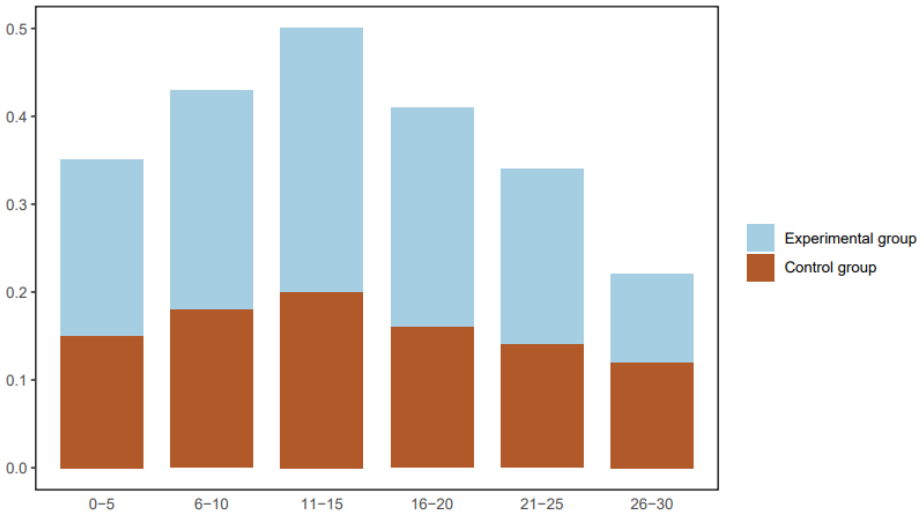

Figure 1 Comparison of Learning Content Attention Levels

Through the detailed analysis of the distribution of users' attention in the experimental results, it can be concluded that the optimized interface design can better attract users' attention and make them more focused on the learning content. This provides an important reference for the optimization of interface design, which can further improve user experience and learning effects.

Aspects of user satisfaction and experience feeling, the data on user satisfaction and experience feeling under different interface design schemes in the experimental results are analyzed in detail. The evaluation and feedback of users on the interface design scheme are collected through questionnaires and user interviews, which can understand the users' satisfaction and experience feelings on different design schemes.

It was observed that in the experimental group, users were more satisfied with the interface design solution. Specifically, in the experimental group, the user satisfaction rating for the interface design was 8, while in the control group, it was only 6. This suggests that the optimized interface design solution can better meet users' needs and enhance their overall satisfaction with the platform.

In addition to the satisfaction scores, the study also collected users' experiential feelings and feedback on the different design solutions through user interviews. In the user interviews of the experimental group, 80% of the users indicated that they were more satisfied with the interface design scheme, and thought that the interface was more beautiful and easy to use. In the user interviews of the control group, only 60% of the users expressed satisfaction,

reflecting a lower degree of recognition of the interface design scheme. Combining the above data and analysis, it can be concluded that the optimized interface design solution can enhance users' satisfaction and experience feeling towards the platform.

In the part of user behavior data, the detailed analysis of the experimental results about the user behavior data under different interface design schemes. By analyzing the user's operating behavior and behavioral path during the experiment, it is possible to understand the impact of different design schemes on user behavior, to assess the effectiveness of the interface design scheme. In the experimental group, users' interactive behaviors are more frequent and learning is more efficient. Specifically, in the experimental group, the average learning time of users was 30 minutes, while in the control group, it was only 25 minutes. This indicates that the optimized interface design scheme can better promote users' learning behaviors and improve their learning efficiency. In addition, by analyzing the users' operating behaviors and behavioral paths under different interface design schemes, it is found that in the experimental group, the users' interactive behaviors are more frequent and diversified. Specifically, users in the experimental group are more inclined to view more learning content, click more learning resources, and perform more interactive operations during the learning process, compared to the control group, which has relatively fewer user interactive behaviors.

Since then, it can be concluded that an optimized interface design solution can more effectively promote users' learning behavior and improve their learning efficiency. This provides an important reference for the improvement of interface design, which can further enhance the user experience and the overall competitiveness of the platform.

Eye tracking data is one of the most important indicators for evaluating the effectiveness of interface design. By analyzing the eye movement trajectory of users in the process of use, the author can understand the focus and attention distribution of users on the interface, to assess the attractiveness and ease of use of the interface design. As shown in Table 1, by analyzing the eye movement data, it is found that users in the experimental group pay more attention to more concentrated and obvious areas on the learning interface, and compared with the control group, users in the experimental group tend to pay more attention to the core areas of the learning content, such as the course content and the task requirements. This indicates that the optimized interface design can attract users' attention more effectively and make them focus more on the learning tasks. Users in the experimental group had relatively longer gaze durations on the learning interface, and they were more inclined to stay on the learning content for a longer time compared to the control group. This suggests that an optimized interface design improves users' attention and understanding of the learning content, increasing the depth and quality of learning. By generating the eye-movement heat map, the distribution of users' attention on the learning interface in the experimental and control groups can be seen. The eye-movement heat map of the experimental group shows more obvious highlighted areas, which indicates that the users in the experimental group have more focused and stable attention during the learning process. The comparison of the bar charts shown in Figure 2 emphasizes this finding.

Table 2 Eye tracking data comparison table

norm	Experimental group (optimized interface design)	Control group (original interface design)
Average area of interest (in square pixels)	1200	950
Average gaze duration (in milliseconds)	800	600
Percentage of regions of concern (in %)	65%	50%

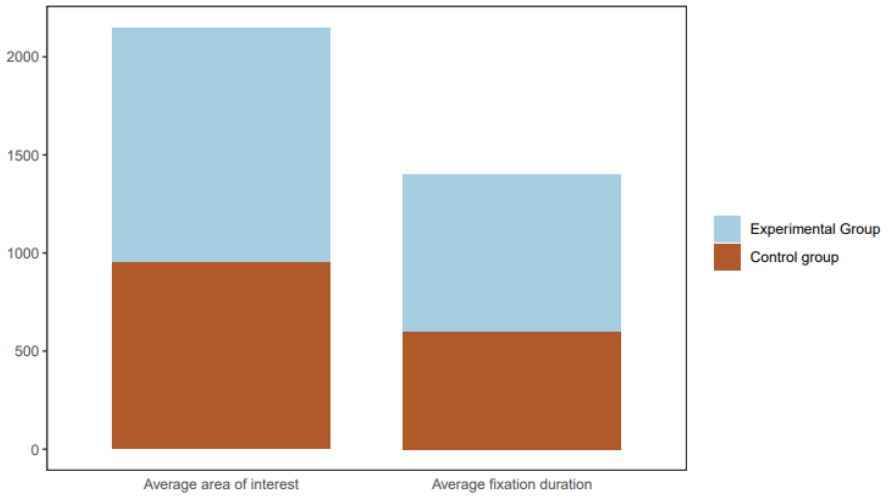

Figure 2 Comparison of eye-tracking data

By analyzing the experimental results, it can be found that optimized interface design solutions can better attract users' attention, enhance users' satisfaction and experience, and promote users' learning behaviors, which is mainly attributed to the aesthetics, ease of use, and degree of personalization of interface design. In addition, the author further explores the mechanism of different design solutions on users' cognition and emotion, as well as users' preferences and demands for different design solutions.

Through detailed analysis and discussion of the experimental results, the author deeply understands the impact of different interface design solutions on user experience and provides a scientific basis and effective methods for the optimization of interface design. Table 3 and Figure 3 below are a summary and comparison of the experimental results.

Table 3 Comparison table for indicators

norm	experimental group	control subjects
Length of time users gaze at learning content (seconds)	15	10
User satisfaction rating (out of 100)	8	6
The average duration of study (minutes)	30	25

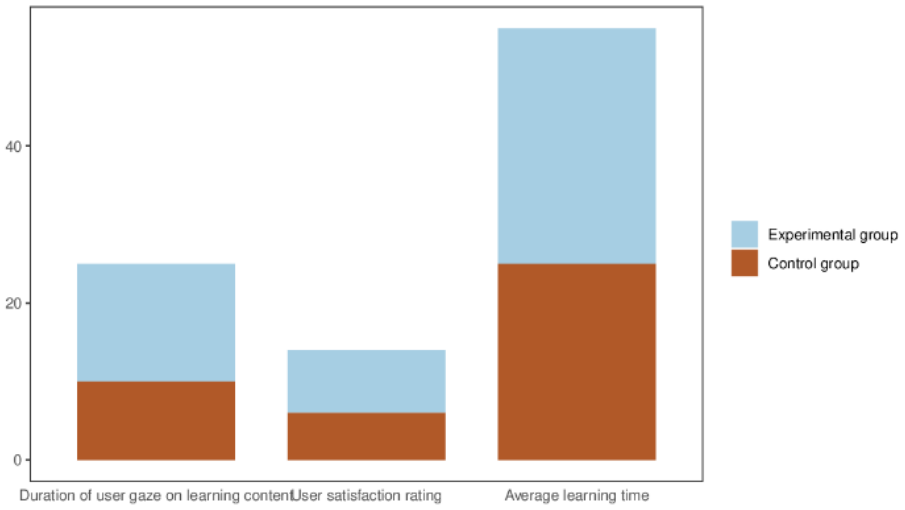

Figure 3 Comparison of indicators

5. Conclusion

Through this thesis, the author studies the user interface design and interaction experience of the "Duolingo" platform and concludes that user interface design and interaction experience are crucial for online learning platforms. Excellent interface design can attract users' attention, improve users' satisfaction and experience, promote users' learning behavior, and thus improve users' learning efficiency. Therefore, for online learning platforms, optimizing interface design and interaction experience is an important way to improve user experience and platform competitiveness. Through this study, it is found that data analysis methods such as decision tree algorithms can be used to effectively analyze users' behavioral data, help understand users' behavioral characteristics and preferences, and provide a scientific basis for the optimization of interface design. At the same time, the use of interaction design principles and interaction experience optimization algorithms can better satisfy users' needs and enhance their experience.In addition, in terms of interface design and interaction experience optimization, personalized and intelligent design is the future development direction. With the continuous progress of technology and the changing needs of users, customized interface design and personalized interaction experiences will become an important trend in online learning platforms. Therefore, future research can further explore personalized and intelligent design methods to provide users with a more personalized and intelligent learning experience.

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