Research on the impact of artificial intelligence recommendation on academic procrastination under the background of big data——The mediating role of mobile phone addiction

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Abstract. With the increase in the number of "head-down people", the phenomenon of mobile phone addiction has attracted much attention, especially for college students. Through empirical analysis, this article surveyed 400 college students, of which 315 valid questionnaires. Under the premise of controlling the individual’s academic self-efficacy, this research explores and proves the mediating role of mobile phone addiction in artificial intelligence recommendation and academic procrastination behavior. Artificial intelligence recommendation positively affects the individual’s academic procrastination behavior, and works by influencing the individual’s mobile phone addiction, that is, mobile phone addiction plays a complete mediating role between the artificial intelligence recommendation and the individual’s academic procrastination behavior.

1. Introduction
With the development of Internet technology, big data and analysis have been raised to new heights, and a recommendation engine system has emerged. The recommendation engine system changes the passive search method that search engines need to implant key information, so that the information becomes more targeted and can better meet the needs of users. On the one hand, the recommendation engine makes all kinds of electronic products more intelligent; on the other hand, this kind of intelligent recommendation makes more people spend more time on the Internet, and even addicted, especially to mobile phone. College students are a high-incidence group of mobile phone addiction. Over-reliance on mobile phones will not only affect students’ physical and mental health but also affect their academic performance. For example, past studies have shown that mobile phone addiction can induce procrastination behaviors, such as academic delays (Zhaochao, Zhai Lin, Wang Chang, 2017). Although many scholars have explored the formation mechanism and influence of individual academic procrastination behavior, few scholars have incorporated big data recommendation, namely artificial intelligence recommendation, into the research content. Therefore, it is necessary to explore the influence of big data recommendation on individual academic procrastination on the basis of previous studies.
2. Literature review and theoretical assumptions

2.1. Artificial intelligence recommendation and academic procrastination behavior

Past studies have shown that people resist algorithmic recommendation. They believe that algorithms cannot be learned and improved (Dawes 1979, High-house 2008). However, with the rapid development of artificial intelligence, people show more love for algorithmic recommendation (Longoni, Cian, 2020). Longoni and Cian (2020) pointed out in their research that the effect of machine language originates from consumers' different perceptions of artificial intelligence and acquaintance recommendations in terms of fun and functionality. People believe that the former has higher perception than the latter. Artificial intelligence recommendations endow the "soul" of mobile phones, making smart phones more interesting and useful. One manifestation of people's mobile phone addiction is their loss of control over the time they use their mobile phones. More than 70% of college students admit to procrastinating in their studies (Esteban & Ramirez, 2014). When students play mobile phones when they should be studying, then the original academic tasks have to be delayed, that is, behaviors of academic procrastination, such as homework delays, late class, and postponed competition events to the last day, etc. Therefore, this article proposes the following hypotheses:

H1: Artificial intelligence recommendation positively affects academic procrastination behavior.

2.2. The mediating role of mobile phone addiction

Student's mobile phone addiction is due to individual factors, such as being addicted to mobile phones out of academic avoidance; on the other hand, it is due to the attractiveness of mobile phones. Specifically, the recommendation engine increases the flow of data and information to designated users by adding mobile phones. The interesting and instrumental nature of the mobile phone makes people spend more time on mobile phones, and even suffer from psychological or physical addiction. In other words, the advancement of artificial intelligence will further promote individual addictive behaviors. For example, when we shop online and want to put down our mobile phones and receive a recommendation of a good-looking costume, we can’t help but continue browsing or continue online shopping behavior; When we were reviewing short videos, we kept pushing related works, casually breaking the rule that we only planned to play for half an hour. The higher the student's perception of artificial intelligence recommendation, the greater the possibility of indulging in mobile phones, and vice versa. Past studies have shown that mobile phone addiction positively affects individuals' academic procrastination behaviors (Zhaochao et al., 2017; Lian Shuilei et al., 2021; Yang Yang et al., 2021). Artificial intelligence recommendation may play a role in individual's academic procrastination through mobile phone addiction. Therefore, this article proposes the following hypotheses:

H2: Mobile phone addiction plays a mediating role between artificial intelligence recommendation and individual academic procrastination behavior.

2.3. Selection of control variables

Academic self-efficacy refers to the evaluation of students' own abilities (including learning ability and problem-solving ability) and possible ability levels in the learning process, that is, whether students have corresponding learning ability or use existing skills for themselves To complete the subjective judgment and evaluation of learning tasks (Gao Yuying, 2018). Students with low academic self-efficacy are prone to evasion and withdrawal in the face of academic management. Facing difficulties in the course, they show lower enthusiasm in their studies, such as being late for class, leaving early, and delaying homework. Past research has shown that self-efficacy affects people's behavior, motivation, effort, cognitive process, and emotional process (Zhou Wenxia, Guo Guiping, 2006). Self-efficacy has been shown to be negatively correlated with procrastination (Yang Yang, Yang Shengyun, Song Wenjing, 2021). Therefore, this study controls individual academic self-efficacy.
3. Research methods

3.1. Research samples and data collection
This study adopted the method of questionnaire survey and obtained 315 valid questionnaires through online surveys, of which 400 questionnaires were returned. The effective response rate of this questionnaire was 78.75%. The subjects of this survey are college students in the school, of which 79.37% are males and 20.63% are females. The educational background is 77.46% for junior college and 22.54% for undergraduate. The variable scales used in this article are all Likert-5 point scales for measurement, "1" means completely non-conformance, and "5" means complete conformity.

3.2. Measuring tools
Artificial intelligence recommendation: According to the connotation of artificial intelligence recommendation, this research has compiled 5 items from five aspects: the degree of data recommendation perceived by the individual, the interest of the recommended content, the instrumental nature, and the length of time the data recommendation uses the individual's mobile phone. The scale has passed the reliability and validity analysis of the data. The Cronbach α coefficient of the scale in this study is 0.822.

Mobile phone addiction: This article modified the scale developed by Bianchi and Phillips (2005) to obtain a scale of 21 items. The Cronbach α coefficient of the scale in this study was 0.915.

Academic procrastination behavior: This article uses the scale developed by Solomon and Rothblum. This study only selects the degree of academic procrastination. There are 5 items in total. The Cronbach α coefficient of this scale is 0.885 in this study.

Academic self-efficacy: This article uses a scale developed by Pintrich and De Groot (1900), with a total of 9 items. The Cronbach alpha coefficient of this scale in this study is 0.913.

4. Data analysis and results

4.1. Confirmatory factor analysis
The data analysis in this paper uses SPSS 24.0 software. The data analysis results show that artificial intelligence recommendation, mobile phone addiction, academic procrastination behavior, academic self-efficacy KMO values are greater than 0.8 and significant, suitable for factor analysis. In this study, Mplus 7.4 software was used to perform factor analysis on the data, and the results are shown in Table 1. The data results show that the fitting index of the four-factor model is better ($\chi^2$/df=2.887, CFI=0.819, TLI=0.810, RMSEA=0.072, SRMR=0.068), while the fitting index of the three-factor, two-factor and one-factor model Significantly lower than the four-factor model. Therefore, it shows that the variables in this study have good discriminative validity.

| Model              | $\chi^2$  | df  | $\chi^2$/df | CFI | TLI  | RMSEA | SRMR |
|--------------------|-----------|-----|-------------|-----|------|-------|------|
| Four-factor Model  | 2837.559  | 983 | 2.887       | 0.819| 0.810| 0.072 | 0.068|
| Three-factor Model | 3866.324  | 986 | 3.921       | 0.719| 0.705| 0.089 | 0.106|
| Two-factor Model   | 6307.559  | 988 | 6.384       | 0.481| 0.456| 0.121 | 0.122|
| One-factor Model   | 7819.050  | 989 | 7.906       | 0.334| 0.303| 0.138 | 0.141|

Note: X=Artificial Intelligence Recommendation, M=Mobile Phone Addiction, Y=Academic Procrastination Behavior, C=Academic Self-Efficacy
The four-factor model consists of X M Y C; The three-factor model is composed of X M Y+C; The two-factor model is composed of X+M Y+C; The one-factor model is composed of X+M+Y+C.

4.2. Descriptive statistics and related analysis
In this study, SPSS 24.0 was used to make a correlation analysis of the variables involved. The descriptive statistics of each variable are shown in Table 2, and a regression analysis between the
variables was made.

Table 2 Descriptive statistics table

|                      | M     | SD  | 1. Academic self-efficacy | 2. AI recommendation | 3. Mobile phone addiction |
|----------------------|-------|-----|---------------------------|-----------------------|---------------------------|
| 1. Academic self-efficacy | 3.407 | 0.724 |                           |                       |                           |
| 2. AI recommendation  | 2.681 | 0.852 | 0.165**                   |                       |                           |
| 3. Mobile phone addiction | 2.530 | 0.697 | -0.030                    | 0.467**               |                           |
| 4. Academic procrastination | 2.243 | 0.882 | -0.163**                  | 0.093                 | 0.331**                   |

Note: N=315, ** means P<0.01, * means P<0.05.

4.3. Hypothesis testing

In order to verify the hypothesis 1 and 2, this paper carried out a regression analysis on the data, as shown in Table 3. According to Wen Zhonglin and Ye Baojuan's (2014) step-by-step test method of mediation, combined with the verification results of model M1-3, that is, artificial intelligence recommendation in M1 positively affects academic procrastination behavior (β=0.123, P<0.01), hypothesis 1 is obtained verification. M3 verifies the effect of artificial intelligence recommendation on mobile phone addiction (β=0.486, P<0.001). In the M2 model, the direct effect of artificial intelligence recommendation on procrastination behavior is not significant (β=-0.046, ns), indicating that the mobile phone is successful Addiction plays a completely intermediary role between artificial intelligence recommendation and procrastination behavior. Hypothesis 2 has been verified.

Table 3 Hierarchical regression analysis

|                      | Academic procrastination | Mobile phone addiction |
|----------------------|--------------------------|------------------------|
|                      | M0                       | M1                     | M2                     | M3                     |
| Academic self-efficacy | -0.163**                 | -0.184**               | -0.145**               | -0.110*                |
| AI recommendation     | 0.123*                   | -0.046                 | 0.486***               |
| Mobile phone addiction | 0.348***                 |                        |                        |
| ΔR²                  | 0.024**                  | 0.035**                | 0.126***               | 0.225***               |

Note: N=315, ** means P<0.001, * means P<0.01, * means P<0.05.

5. Conclusion

This paper verifies the influence of artificial intelligence recommendation on students' academic procrastination behavior in the context of big data, and proves the complete mediating role of mobile phone addiction. This research has certain theoretical and practical significance. At the theoretical level, this research has enriched the relevant research on academic procrastination, and is an important supplement to the field in the context of big data. On the other hand, the research results show that while big data recommendation brings convenience to people, it will also bringing certain negative effects, such as greatly increasing the probability of individuals indulging in mobile phones. Therefore, this research provides a negative empirical evidence for artificial intelligence recommendation related fields. At a realistic level, this study proves that mobile phone addiction will further affect the individual’s academic procrastination. Therefore, it has a certain guiding role in the management and control of students’ mobile phone use when carrying out college education.

The shortcomings of this study are in the following three aspects: First, the survey subjects are mostly junior college students, and the specific behaviors of academic procrastination are not comprehensive enough; second, the boundary mechanism of artificial intelligence recommendation to the behavior of academic procrastination needs to be further explored; third, this The study uses cross-sectional data, and there is a certain degree of data deviation. Therefore, improvements can be made from the following three aspects in the future: firstly, expand the scope of research and further explore
the behavior of academic procrastination; secondly, explore the boundary mechanism between artificial intelligence recommendation and academic procrastination; thirdly, use longitudinal data to increase the stability of the data.

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