A Review of Educational APP
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Keywords: Mobile education, Education APP, Evaluation system, Application classification.

Abstract. The application of mobile web application (APP) technology in the field of education informationization is gradually enriched. However, according to the relevant literature reviewed, there is still a lack of systematic and comprehensive research in this field at home and abroad. The problems of educational APP in education are expounded by summarizing the development of mobile network technology, the meaning of educational informationization, and the classification of educational APP. By summarizing the research status and trends of APP applied to education, it can provide useful reference.

Introduction
In recent years, with the development of mobile networks and mobile devices (mobile phones, tablets, etc.), mobile learning has been widely used. (Tang Yueming, 2016) believe that mobile learning is the support of learners on the network and terminal devices (smart phones, pads, e-readers, etc.), which allows learners to be able to work anywhere according to their needs [1]. It is a new form of distance learning that offers learners a lifelong learning experience. The excellent characteristics of mobile technology in education have been highly concerned by educational researchers (Cela, Sicilia, & Sánchez, 2015; Fu & Hwang, 2018) [2,3]. As an indispensable mobile APP in mobile learning (i.e., educational APP), it is an educational software that can run on mobile terminals, which plays an important role in the development of mobile learning. Although some researchers have conducted research on educational APP from different perspectives in recent years, there is less systematic review of the research status of educational APP. Therefore, this paper collates the relevant research literature at home and abroad for nearly 10 years. This paper summarizes the basic concepts, characteristics and classification of educational APP. In order to promote the research of educational APP information technology in the field of education, this paper reviews the research on the quality and evaluation of educational APP.

Research on the Concept, Characteristics and Classification of Education APP

Concept of Educational APP
Zhang Fengdan, Chen Shipin (2017) think that education APP refers to a general term for a kind of APP that can provide learners with learning resources, learning platforms or skill training [4]. Ma Yuhui, Zhao Le, Li Nannan, Wang Shuoshuo (2016) defined educational APP from the perspective of learning resources as an application that runs on smart mobile terminals and can help learners learn [5]. Xu Peng (2017) defines educational APP as software for human mobile learning services [6]. Notari, Hielscher, and King (2016) argue that educational apps are applications that implement learning-related goals [7].

Main Features of Educational APP
Matthew Kearney (2012) considers that authenticity, collaboration and personalization are three core features of mobile learning [8]. Liu Dan (2016) believes that mobilization, socialization, gamification, personalization, intelligence, and contextual interaction are the characteristics of educational APP [9]. Li Nannan (2016) believes that large-scale, easy-to-use and light applications are the main features of educational APP [5]. Gao Ning (2017) describes the characteristics of
educational APP from two aspects: perceived ease of use and perceived usefulness. Perceived ease of use means simple operation and practicality. Intelligent and personalized. Satisfying the cognitive needs of learners, social needs, emotional needs are perceived usefulness [10].

**Classification of Educational APP**

Different scholars further classify educational APP from different perspectives. (Wang Ting, 2016 & Liu Dan, 2016) divided education APP into seven categories, namely learning games, cross-reference application classes, correction tools, enhanced e-books, program management tools, and special education from a functional perspective. According to the service target group of the Education Press [9,11], Yan Li (2017) mainly divides the education APP into classroom-assisted, textbook-assisted, subject-specific, teaching platform-type, and auxiliary tools. From a cognitive perspective [12], Cherner (2014) divides educational APP into three categories: skills, content, and function. From the perspective of the way of knowledge construction and the way of knowledge acquisition [13], Li Nanan (2016) examines the learning scenarios and proposes an educational APP classification framework based on learning scenarios[14]. The horizontal axis is divided according to direct experience and indirect experience. The vertical axis indicates whether it is individual learning or group learning. According to this classification, five types of education APPs are formed: teaching support, individual self-study, seminar learning, doing with learning and working situations.

Xu Peng (2017) believes that the current classification method lacks theoretical basis and certain practical significance [6]. Based on learning theory and cognitive goals, it aims at the deep integration of mobile technology and education and teaching. According to the TIM model, APP are classified according to the learning environment, the stage of technology use, and the discipline. Xu Peng's method is more comprehensive and more detailed. Integrating the SAMR, TPACK and TIM model aimed to accurately guide teachers’ technical use and achieve effective integration of technology and education.

Therefore, in the existing classification research, the author believes that Xu Peng’s classification method is more scientific. The ultimate goal is to integrate teaching and learning. His classification considers multiple dimensions such as the subject environment, and the classification is more detailed. But there are still certain problems, such as not considering the teaching method, learning task design.

**The Study of the Quality of Education APP**

Li Mang (2017) mentioned the famous "Question of Jobs": "Why does IT change almost all areas, but the impact on education alone is surprisingly small?" So how does education APP work? What kind of problems are there now? What kind of measures to take is also worth pondering. By searching the literature, system quality, information quality and service quality are three aspects of current educational APP quality research.

| research content | Source of literature |
|------------------|----------------------|
| System quality   | Zhan Qinglong, (2009) (Gao Ning, 2017) (Chen Mingming, 2010) (Natalya Rashevska, 2015) |
| Information quality | (Gao Ning, 2017) (Yan Li, 2017) (Chen Ying, 2015) (Wang Ting, 2016) (Zhu Zhiting, 2016 & Jane Y-K Yau and, Mike Joyren, 2010) (Yang Xuhui, 2014) (Matthew Kearney, 2012) |
| service quality  | (Wang Gang, 2017) (Shu-Sheng Liaw, 2010) (Chen Ying, 2015) (Si Guodong, 2015) (Sun Yulin, 2015) |

**APP System Quality**

Based on the theory of quality engineering configuration, Zhan Qinglong (2009) constructed a model of mobile learning resource construction quality house, which aims to explore the
relationship between technology, resources, services and learner needs in mobile learning[15]. The results show that support service technology is very important and the quality of platform system affects the whole process of mobile learning. Based on the analysis of the results of the “job help” and “live course” education APP research, Gao Ning (2017) believes that China’s mobile education lacks innovative spirit, which technology and practice cannot be well matched. And there are problems with the design of the APP [10]. Chen Mingming (2010) believes that the stability of the mobile education platform operation, no failure rate and battery life have an important impact on the user experience [16]. Natalya Rashevska (2015) believes that mobile learning is influenced by the level of modern information and communication technology, and the development of hardware infrastructure will also play an important role[17].

APP Information Quality

Gao Ning (2017) found that the number of educational APPs has increased sharply, but the quality of information resources is problematic. More is to copy the offline content to the online, which has a negative impact on the development of educational APP [10]. Yan Li (2017) also has similar conclusions. He believes that there is a problem in the quality of educational APP information, and the advantage of educational publishers in developing educational APP is that they have professional knowledge and authority, which can guarantee the quality of educational APP information resources. Based on the results of the education APP survey for the primary school market in the Apple Store and the Android Store[12].Chen Ying(2015) found that nearly 40% of these companies did not investigate user needs and the content was mostly resource-stacked[18]. It means that content has everything but is not targeted and cannot meet the needs of users. It can be seen that there are certain problems in the quality of educational APP information at present, and most of them are the compilation of information resources.

Based on the research and analysis of the top 100 software apps in the Apple Store, Wang Ting (2016) believes that educational APP software should push the content what target audiences need and provide personalized services[11]. In order to meet different learning needs, (Zhu Zhiting, 2016 & Jane Y-K Yau and, Mike Joyren, 2010) believe that accurate teaching should be implemented to build personalized teaching methods and applications[19,20].Yang Xuhui (2014) proved that personalized content push and service will effectively improve learning results through experiments[21]. It believes that learners are the objects of service and should clarify their needs. In addition to the provision of learning resources, explicit and invisible services should be strengthened. Explicit service mainly refers to the technical service of the platform and implicit service refers to the development of a learning plan for learners to supervise and urge learners to learn. Matthew Kearney (2012) believes that mobile education software is needed to consider the characteristics and specific needs of learners, as well as the environmental location of learning, teacher preferences and characteristics [8]. These experiments prove that pushing the information content for the user's individual needs can enhance the learning effect and improve the user's satisfaction of the information quality.

APP Service Quality

The interface design of educational APP, the improvement of human-computer interaction will help to improve the usefulness of educational APP and contribute to the promotion of APP. Based on the experimental results, Wang Gang (2017) concluded that the effect of interactive mobile learning is significantly better than traditional computer teaching [22]. Shu-Sheng Liaw (2010) believes that improving user satisfaction, giving learners autonomy, enriching system functions, and enhancing interaction and communication activities can have a significant impact [23]. Based on Apple and Android's primary and secondary education APP market for data research and analysis, Chen Ying (2015) found that downloading more than 100,000 APP has targeted interface design and good interaction design [18]. Such apps with low downloads have poor interface interactivity, which is not conducive to finding interactions and inefficiency. Based on the theory of multimedia cognition, Si Guodong (2015) thinks that interface design is a difficult problem of mobile education software from the perspective of cognition, which should pay attention to interface layout and make simple
interaction [24]. Sun Yulin (2015) put forward three suggestions for mobile education software for children. It should strengthen voice interaction, graphic interaction and gesture interaction to meet children's needs [25].

In summary, the improvement of service quality can improve user satisfaction and have a significant impact on learning effectiveness and efficiency.

**Research on Evaluation of Education APP**

The research on education APP evaluation mainly includes three aspects, (1) evaluation of learning effect based on user as evaluation subject (2) evaluation of learning resource based on APP platform as evaluation subject (3) evaluation system construction.

| research content               | Source of literature                                    |
|-------------------------------|---------------------------------------------------------|
| Learning effect evaluation    | (Wei Wenrong, 2016) (Wang Ying, 2017) (Fan Kaiguo, 2016) |
|                               | (Xie Zhongxin, 2013)                                    |
| Learning resource evaluation  | (Zhang Wei, 2001) (J. Vargo, 2003) (Chen Mingming, 2010) |
|                               | (Cheng Wei, 2014)                                       |
| Evaluation system construction| (Shi Shuen, 2001) (Li Zheng, 2004) (Zhang Guowei, 2009) |
|                               | (Qian Dongming, 2014) (Huang Wei, 2016) (Zhang Wei, 2019) |
|                               | (Gong Chaohua, 2018) (Song Lina, 2015) (Wang Lizhen, 2019) |

**Evaluation of Learning Effects Based on the Perspective of the Use Results**

In view of the characteristics of mobile education, Wei Wenrong (2016) believes that mobile learning is different from traditional learning interaction methods, and proposes three levels of evaluation on learning effects: platform evaluation, student evaluation and satisfaction evaluation [26]. Through experiments in the art major, Wang Ying (2017) proved that effective online performance evaluation can improve students' interest in learning and narrow the cognitive differences between teachers and students [27]. And a new evaluation method is proposed. The total learning effect consists of three parts: data collection, online collaboration and online scores.

Based on the evaluation of classroom teaching effects, Fan Kaiguo (2016) believes that the subject to be evaluated should not only have students, but also teachers [28]. Xie Zhongxin (2013) pointed out that the current evaluation of classroom teaching effectiveness is biased in the evaluation of classroom teaching evaluation, which aims to serve the school management teachers rather than to feedback the students' results to the teachers to enhance their teaching. Method [29].

**Evaluation of Educational APP Mobile Information Resources**

Zhang Yong (2001) summarized the evaluation methods of network information resources. The evaluation methods can be divided into third-party evaluation, self-evaluation and network measurement [30]. The three-party evaluation is the main form, and the resource assessment is more oriented with information content and information form, but this method is subjectively affected. J. Vargo (2003) proposes a LORI model on learning objects, which mainly includes indicators such as content quality, accessibility, and reusability [31]. Chen Mingming (2010) believes that the impact of learning resources is mainly concentrated on the advantages and disadvantages of learning resources and the ease of operation of the platform [32]. On this basis, foreign scholars measure the evaluation of learning resources from the three dimensions: support, ease of use and quality. Cheng Gang (2014) builds a mobile learning resource evaluation model based on LORI, which includes 1) overall learning experience and consistency; (2) content quality; (3) content quantity and granularity; (4) interaction design (including human-computer interaction and social interaction); (5) accessibility; (6) media Characterization; (7) learning evaluation and feedback; (8) situation adaptation and personalization. Accessibility and human-computer interaction are most concerned by users [33].
Evaluation System Construction

There are two ways to construct the evaluation index system. The first is from the top to down. First set up the first-level indicators, then set up the second-level indicators, and then continue to refine the formation of the evaluation index system. The second is to conduct field research through bottom-up, improve on the basis of existing indicators, and design a corresponding evaluation index system. In the top-down approach, more research has been done. First, Shi Shuen (2001) first constructed an evaluation index system for the original computer-aided teaching software [34]. Its evaluation index system mainly includes three categories of indicators: technical function indicators, educational function indicators and media application function indicators. Li Zheng (2004) believes that the quality of a software is too one-sided from the perspective of pure technology, so the evaluation index system constructed by it evaluates the quality of software from three aspects: technical perspective; learning psychological perspective; language learning perspective [35]. Zhang Guowei (2009) put forward seven basic principles and specific evaluation criteria for the final evaluation of language teaching software, covering language guidance, content design and interface design [36].

Summarizing the literature, it is found that there are fewer studies on constructing the evaluation index system from the bottom up. Qian Dongming (2014) designed the evaluation index system of education website in this way [37]. The model mainly consists of five parts, in which the information content, teaching characteristics and website design are qualitative indicators, and the technical level and website benefit are quantitative indicators. Some scholars' research perspectives focus on the user experience. Huang Wei (2016) designed a set of evaluation index system consisting of application platform, user experience, visual front desk and network background through analytic hierarchy process [38]. Based on the experimental results, it is concluded that the user experience is the main factor affecting APP quality. Based on the D-S evidence theory, Zhang Wei (2019) constructed a mobile learning APP evaluation index system from the perspective of user experience, which mainly consists of five parts: pleasure, reliability, accessibility, usefulness and interactivity [39]. The usefulness weight is up to 0.3336, followed by interactivity and pleasure. Based on the principle of user experience design, Gong Chaohua (2018) designed the evaluation index system based on the precise teaching in the smart learning environment, and constructed the teaching (Pedagogics), art (Art), content. PACTS model consisting of (Content), Technology, Service [40]. Referring to the award-winning children's education app selected by the US non-profit organization Commonsense, Song Lina (2015) believes that the evaluation subject should be diversified, and parents play an important role in it [41]. Based on the game theory, Wang Lizhen (2019) evaluates from a multidimensional perspective [42]. The multidimensional objects in the evaluation study are defined as developers, deliverers, instructors, and learners.

Conclusion

In summary, it can be seen that the education APP relies on its own ease of use and practicality the study of educational APP mainly focuses on two aspects of design and evaluation. Research on educational APP design focuses on content design, interaction design and structural design. Structural design and interaction design mainly provide explicit services, which can make the system run more smoothly and learners have a better experience. The content design is mainly implicit service, which provides learners with more personalized choices to meet the needs of different consumers. How to provide better interface design, improve interaction, and meet the different needs of learners will be the focus of future research.

The research on the evaluation of educational APP mainly focuses on the evaluation of learning resources, the evaluation of learning effects and the construction of the overall evaluation index system. The current evaluation index system has basically included evaluation of learning effects and evaluation of learning resources. The current research is more than a top-down evaluation index system. In the past, the evaluation index system was constructed from three aspects: learners, learning resources and platform construction. In recent years, based on game theory, some
evaluation studies have focused on multi-subject research. It takes enterprises into consideration, which is more practical.

Acknowledgement
This research was funded by the National Natural Science Foundation of China under Grant (71402159) and Educational and Teaching Reform Fund of Yunnan University (2019).

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