

Teaching Reform Approaches for Mobile Application Development Integrated with HarmonyOS

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Abstract: *With the continuous advancement of mobile communication technology, the emerging operating system HarmonyOS has a promising future in the field of mobile application development. This study mainly focuses on the innovation of teaching model integrating HarmonyOS into the mobile application development courses in colleges and universities, carefully analyzes the problems in the current teaching system, and provides some systematic improvement plans from the improvement of course content, the update of teaching methods, the establishment of practice platforms, and the cultivation of teaching staff to train application-oriented compound talents who have both HarmonyOS development capabilities and innovative ability, promote the integration of higher education with industry needs, and propel the HarmonyOS ecosystem towards sustainable development through these reform measures.*

Keywords: HarmonyOS; Mobile Application Development; Teaching Reform; Integration of Industry and Education

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1.Introduction

Amidst the rapid evolution of mobile internet, diverse applications have ubiquitously integrated into critical societal domains—spanning social entertainment, business operations, healthcare, and smart cities—demonstrating profound strategic significance. Amidst escalating industry needs, it faces acute challenges to cultivate specialized talents in mobile application development faces acute challenges, imposing heightened requirements for practitioners' technical proficiency and innovative mindset. In this situation, as the main places for cultivating high-quality talents, higher education institutions integrate HarmonyOS into the curriculum system of mobile application development, which has important strategic significance, is beneficial for students to comprehensively grasp cutting-edge technical knowledge, enhances their advantages in career development, provides intellectual support for the creation of the HarmonyOS ecosystem, propels tighter integration between higher education and industrial practices, improves resource allocation, enhances their ability to serve society, and promotes the common progress of educational aims and industry needs.

2.The Challenges Faced by Current Mobile Application Development Teaching

2.1 Outdated Teaching Content

At present, the mobile application development education system is mostly concentrated on the two mainstream platforms of Android and iOS. Educational resources pertaining to HarmonyOS remain comparatively scarce. With the continuous expansion of the HarmonyOS ecosystem, its unique programming language and distributed task scheduling mechanism and other novel technologies are gradually emerging. However, the current course content does not well reflect the development trends of these emerging technologies, resulting in significant misplacement between teaching content and industry needs. The scarcity and slow updates of textbook resources make it difficult for teachers to find systematic and authoritative teaching materials in class, thereby limiting the improvement of teaching quality. Students encounter significant obstacles in mastering theoretical knowledge and cultivating

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practical ability due to insufficient practice case studies.

2.2 Weak Practice Teaching

Mobile application development is a highly practical discipline. There are many difficulties in the teaching process. Current university experimental platforms struggle to comprehensively replicate the complete HarmonyOS development ecosystem. Especially for multi-terminal collaborative testing, it is quite complex to build the required hardware facilities and network architecture, making it difficult for most universities to effectively carry out such course design. Moreover, due to the constraints of confidentiality of enterprise projects and other factors, it is difficult for students to fully participate in core development work during their internship, which limits the practice effect. These factors are intertwined with each other, resulting in that graduates struggle to quickly meet to the job requirements of HarmonyOS application development upon graduation [1].

2.3 Insufficient Qualified Teachers

HarmonyOS, as a revolutionary technological platform, exhibits low penetration among university faculty. Currently, educators are lack of specialized professional training on HarmonyOS development and operational experience. There are obvious shortcomings in their knowledge system, making it difficult to provide students with systematic and in-depth technical guidance. Due to teachers' limited understanding of the latest developments and actual demand in the HarmonyOS field, the relevance and practical value of related course content will inevitably be constrained.

3.Strategies for Teaching Reform of Mobile Application Development Integrated with HarmonyOS

3.1 Innovating Teaching Methods

Guided by the project-based teaching philosophy, this study selects HarmonyOS application development as the carrier, integrates the main knowledge points of the course into specific project tasks, and designs a HarmonyOS service platform for campus, which has course information query, campus map navigation, club activity promulgation and other functional modules. The aim is to guide students to deepen their theoretical comprehension and enhance their programming proficiency in real-world application scenarios. An online and offline blended teaching model is adopted. Online, students rely on high-quality resources such as Huawei Developer Community and XuetangX for self-study and watch HarmonyOS tutorial videos. Offline, classroom lectures, group discussions, and practice are used to promptly resolve technical problems, enhance the interaction and communication between teachers and students, promote teamwork, thereby greatly improving teaching effect and comprehensively enhancing students' comprehensive quality.

3.2 Building Practice Platforms

It is necessary to strengthen the infrastructure construction of on-campus laboratories, configure a variety of HarmonyOS development tools and Huawei terminal devices, and create the efficient and stable multi-terminal collaborative development environment to meet the needs of students to carry out HarmonyOS application practice. And it is necessary to establish school-enterprise joint training bases, strengthen cooperation with enterprises such as Huawei, and jointly build training platforms. Enterprises offer students the opportunity to develop real projects, allowing them to participate in the research and development of HarmonyOS technology and accumulate practical experience. Colleges and universities, by leveraging their own advantageous resources, provide high-quality professional talents for enterprises, promoting the common development of both sides.

3.3 Strengthening the Construction of the Teaching Staff

It is necessary to establish a HarmonyOS teacher training system, arrange for core teachers to participate in Huawei-certified official training courses, and obtain corresponding qualification certificates through assessment to enhance the professional quality of teachers, rely on the company's resources to invite external experts to give

special lectures and training guidance, and regularly invite senior HarmonyOS developers to share and discuss technologies, broaden teachers' knowledge horizons, improve their practical ability, encourage them to actively participate in school-enterprise cooperation projects, and go deep into the front line of enterprise research and development to personally experience the entire process of HarmonyOS application development during winter and summer vacations or on-the-job training, and thus integrate typical cases into classroom teaching to improve teaching quality.

4.Expected Outcomes of Teaching Reform

4.1 Enhancing Students' Professional Competence

After systematic study and practice, students can fully master the key technologies of HarmonyOS application development and establish a technical system covering from demand analysis to product completion. In terms of distributed application development, students can proficiently use key technologies such as distributed task scheduling and data management to achieve efficient collaboration among multiple terminals. In terms of smart campus, its main functional modules can achieve real-time synchronization of classroom electronic whiteboards, students' tablets, and teachers' mobile devices, and adjust display effect and interaction forms according to different device characteristics.

The improvement of data management capabilities is reflected in the systematic integration and application of technologies such as distributed databases, local-storage, and cloud synchronization. Taking a family finances application as an example, it employs mobile devices for data input, tablets for analytical processing, and smartwatches for notifications to achieve cross-device data synchronization, and uses data encryption technique to ensure information security. During the project implementation, students must address various challenges, such as device compatibility, network latency, and energy consumption optimization. In the development of outdoor sport scenarios, it is particularly important to balance the coordination between the positioning accuracy and data transmission speed of smartwatches in low battery state. Such operations can enhance students' holistic problem-solving ability. And the cultivation of technological innovation capabilities focuses on the close integration of technology with specific application scenarios. For instance, HarmonyOS atomic services are relied upon to design the plans for the dissemination of intangible cultural heritage, and AR technology is used to create the interactive sections of paper-cutting art. Users only need to scan with their mobile phones to obtain dynamic paper-cutting effect.

4.2 Enhancing Students' Employment Competitiveness

Graduates with HarmonyOS development skills have a distinct advantage in the job market. As Huawei Ecosystem continues to expand, the demand is constantly increasing for HarmonyOS professionals in the fields, such as smart homes, intelligent connected vehicles, and industrial Internet, which brings more opportunities to traditional mobile application development posts. Moreover, and produces new careers, such as cross-terminal integration, microservices architecture design, and meta-service development. The experience accumulated in school-enterprise cooperation projects holds critical significance. Participating in the research and development of HarmonyOS applications for enterprise-level intelligent household electrical appliances and being responsible for the improvement of the interaction interface of the food recognition module, these experiences can greatly enhance the comprehensive quality of job seekers. Such practical experience is beneficial for candidates to give solutions of technical problems more accurately during interviews, thus outperforming opponents who merely rely on theoretical knowledge.

Deeply integrating the skills certification mechanism into the talent cultivation system cannot only significantly optimize the employment competitiveness of graduates, but also lay a solid foundation for their career development. Taking Huawei Developer Certification as an example, trainees who pass the assessment and are registered in the system will be given convenient conditions such as priority recommendation. Pilot data from a certain university

shows that starting salary of students who have completed the HarmonyOS application development certification is approximately 15% higher than that of those without the certification. Moreover, they perform better in terms of participation in key projects. Competition results have also become an important extra point column in the job search. Students who win awards in HarmonyOS application development competition are often valued by many enterprises. Some outstanding individuals have realized their entrepreneurial dreams ahead of schedule by virtue of their own practice projects. After a campus second-hand goods trading App based on HarmonyOS was launched in schools, it quickly attracted over 100,000 users^[3].

4.3 Promoting the Development of the HarmonyOS Ecosystem

The HarmonyOS Ecosystem is filled with a variety of fresher energy. Among its core driving forces lies the enthusiasm of many students for participation. In the field of education, the HarmonyOS application mainly promoted by students is called Virtual Laboratory. It achieves a perfect integration of experimental equipment data and theoretical knowledge through distributed technology. This type of software has been promoted in many middle schools and filled the market gap of HarmonyOS educational software. In the field of public services, the simplified HarmonyOS health applications tailored for the elderly has been favored by community elderly care institutions by virtue of its improved interface layout and interactive process. During this period, although all the development work was undertaken solely by the students, these achievements have been highly aligned with the actual demand, adding many new possibilities to the development of various applications of HarmonyOS.

Under the guidance of their mentors, university students have carried out innovative practice on HarmonyOS technology, especially the research achievements centered on the HarmonyOS microkernel. From the optimization of algorithm with low power consumption to the design of cross-device privacy protection mechanism and many other aspects, they have made considerable progress in patent application and actual product development. The open-source approach has also enhanced the influence of the ecosystem. A HarmonyOS interface component library spearheaded by a certain team, featuring cross-device adaptability and seamless integration, has surpassed 10,000 downloads on open-source platforms, significantly boosting third-party application development efficiency. After joining in work, graduates have gradually become the core force in the HarmonyOS Ecosystem, and promoted more enterprises and developers to join in the construction of the HarmonyOS Ecosystem with the help of career development paths, and a virtuous interactive mechanism of “research and development - deployment - feedback - upgrade” has been formed.

4.4 Deepening the Integration of Industry and Education

The innovation and transformation of teaching models in the field of higher education have promoted the in-depth development of the school-enterprise collaborative education mechanism. Enterprises have been deeply involved in course design, organically integrated the latest technical standards and vocational skills requirements of the industry into the teaching system. Taking the textbook “HarmonyOS Cross-Device Development: Practical Implementation Guide” jointly written by Huawei engineers and university teachers as an example, each chapter of it is embedded with the thin training tasks of real enterprise projects, thereby significantly shortening the time for the transformation of theoretical knowledge into practical operations. The jointly built training bases have become the key platforms for the transformation of technological achievements, enabling the scientific research results of universities to be verified and improved in the specific scenarios of enterprises. According to the tests conducted by the cooperative enterprises, the application of this HarmonyOS device energy consumption monitoring algorithm has increased the battery life of smart wearable products by approximately 20%, which well demonstrates the real effect of the deep integration of industry, university and research.

The innovative approaches that university teachers promote teaching quality improvement through enterprise practice shows that teachers can gain experience through practice, and then turn this experience into teaching resources to improve classroom effect. After participating in the development of the HarmonyOS protocol, the

teachers from a certain university incorporated the design concept of encrypted transmission protocol into the course teaching, leading students to create a middleware system that supports the interconnection of multiple brands of home appliances. This “practice - teaching - re-practice” cycle ensures that teaching content always keeps up with the latest industry trends. The integration of industry and education promotes the efficient integration of educational resources. The R&D tools and software licensing donated by enterprises have effectively solved the problem of shortage of experimental equipment in colleges and universities. Schools provide technical support and talent reserves for enterprises’ technological innovation, significantly reducing their R&D expenditures and human input, and achieving integrated development of industry, university, research and application ^[4].

5.Conclusion

Incorporating HarmonyOS into the mobile application development course system not only conforms to the trend of technological development, but also meets the needs of the industry. Through various means, such as improving teaching content, updating teaching models, building practice platforms, and improving the teaching staff, it can effectively make up for the deficiencies of the current courses, improve teaching quality, cultivate high-level compound talents with HarmonyOS development capabilities, innovative mindset and practical skills, which is beneficial to optimizing students’ comprehensive occupational qualities and employment competitiveness. Moreover, it can provide talent support for the development of the HarmonyOS Ecosystem and promote the integration of the higher education and industry development, thereby deepening the function of education in serving society. During the period of education reform, it is necessary to pay attention to the latest developments of HarmonyOS technology, continuously improve the curriculum system and teaching methods, deepen the intensity of school-enterprise joint education, and focus on cultivating high-level professional and technical talents in mobile application development to provide strong talent support for the long-term development of China’s information technology industry.

References:

- [1] Li Liu, Yunfeng Ji, Tao Li, et al. (2025) *The Teaching Model of Internet of Things Mobile Application Development Course Based on Project Actuation*[J]. *Internet of Things Technologies*, 15(13), 157-159+162.
- [2] Jie Guo. (2025) *Teaching Reform of the “Mobile Application Software Development” Course Oriented Towards Real Demands*[J]. *East China Science & Technology*, 5, 130-132.
- [3] Meijia Huang, Zonghui Li and Ruibin Chen. (2024) *Teaching Reform Strategies of Mobile Application Development Course under the Background of Educational Digitization and Artificial Intelligence*[J]. *Journal of Guangdong AIB Polytechnic*, 40(03), 54-59.
- [4] Shuping Cheng and Xiaoyan Wu. (2023) *Teaching Reform of Mobile Application Development under the CDIO Model*[J]. *Journal of Fujian Computer*, 39(02), 118-120.